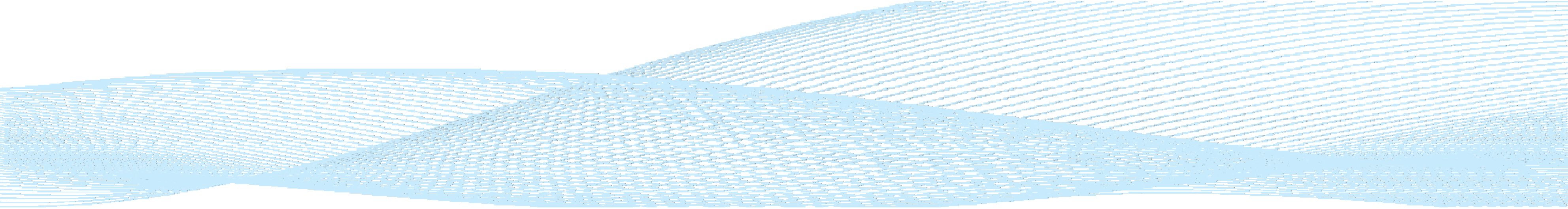
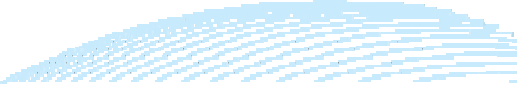
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**MultiMech**

**Communication & Command**

**Reference Manual**

**2012-01 Code**

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|  |  |  |
| --- | --- | --- |
| **1** | **INTRODUCTION** |  |
| **1.1** | **Change history**  Ver. 01 2011-04-13 | Initial version |
| **1.2** | **Purpose** |  |

This document describes the application, session, data link and physical layer of the communication protocol implemented in the MultiMech.

The protocol is very similar to the NMD50 2019-02 firmware.

The document is intended as a reference for system analysts and developers involved in the task of integrating the MultiMech into dispensing automation products.

**1.3 Overview**

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**1.4 Versions**

This document is valid from the following firmware configuration.

MultiMech 2012-01-02

Definitions and Conventions

**1.4.1 Firmware version code**

The six digit Firmware Version code, XXXX-YY.ZZ, is explained and changed as follows:

XXXX = Program Type. The two last digits indicate the module, hardware compatibility and functionality of the firmware. XXXX= 2012 for MultiMech Controller firmware.

YY = Version Number. This number changes when new features or major functional changes have been made

For example:

• A new format or change to a command or a reply.

• An incompatibility with old hardware.

ZZ = Revision Number Changed when the program has been updated or corrected. The release is fully compatible with previous revisions

**1.4.2 Conventions in this Manual:**

Throughout this manual we will refer to standard ASCII characters enclosing them within brackets, meanwhile their internal hexadecimal value will be represented between inverted commas preceded by letter X.

Example:

The character combination 0A (zero and a letter A)

Hex. Value…..................X’30’X’41’

**1.4.3 Vocabulary**

ATM Automatic Teller Machine CMC Central Machine Controller FW Firmware

I/F Interface

MDDM Multi Denomination Dispense Mechanism

NC Note Cassette

ND Note Diverter

Network The external device where the application for the MultiMech is executed. The “network” could be a Host, a Terminal controller or a Personal Computer

NF Note Feeder

NMD Notes and Media Dispenser

Note “Note” also refers to other documents besides banknotes. NQ Note Qualifier

PS Power Supply

RV Reject compartment in the upper note tray

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**2 PHYSICAL DESCRIPTION**

**2.1 System Structure**

The MultiMech is a two channel dispensing mechanism. It cannot be upgraded to support additional feed channels. The reject compartment is integrated into part of the upper note tray.

The mechanism is controlled by a PCB mounted on the side of the mechanism.

**3 LOGICAL DESCRIPTION**

**3.1 Dialogue procedures**

The MultiMech Controller is designed to be controlled by an external device. We will refer to this device as the NETWORK. From the logical point of view, the MultiMech Controller cannot perform any operation without receiving a COMMAND from the Network.

After receiving a COMMAND, the MultiMech Controller will try to execute it, sending back to the network the adequate STATUS REPLY, regardless of whether the operation has been successfully executed or not.

The MultiMech will never send any message to the Network, unless it had been previously activated by a command.

The dialogue procedure between the MultiMech and the Network is always established in PAIRS OF MESSAGES, which must be initiated always from the Network.

Figure 3.1: Dialogue procedure

Network

MultiMech

|  |  |  |
| --- | --- | --- |
| Command |  |  |
|  | |

Reply

**3.2 Commands overview**

Possible commands available to handle the system are listed below. However, not all of them are strictly required for common operation at the user site. Each one of the commands is identified by an operation code, 1 byte long, in Hex code.

For everyday normal operation, only 5 commands are strictly required. These are:

X’32’ ………. MOVE FORWARD X’35’ …........ READ CASSETTE-ID. X’37’ …........ CLOSE CASSETTE X’38’ …........ OPEN CASSETTE

Any Application Program to drive the MultiMech should always begin the “Start-of-day” procedure by sending to the system an “Activation Routine”, which basically consists of two commands: the X’38’, OPEN CASSETTE, to load note tray internal parameters, and then the X’35’, READ CASSETTE-ID, to read the Cassette numbers.

X’38’ …......... OPEN CASSETTE X’35’ …......... READ CASSETTE-ID

Notes are then issued by sending an X”32” MOVE FORWARD

command.

For the end-of-day procedure an X’37’ CLOSE CASSETTE

command must be sent.

**3.3 Status reply overview**

As stated in paragraph 3.1, the dialogue procedure between the MultiMech and the network, is established in pairs of messages. That means that each one of the commands issued to the system will send its own REPLY STATUS MESSAGE back to the network.

In general terms, each reply message contains three different types of information:

General status code Hopper status code Relevant information data

The *General status code* tells the network what the final result of the transaction has been. It is a 1 byte ASCII character, at the beginning of the reply message.

The *Hopper status code* gives information about the particular situation of each one of the different hoppers. It is also a 1 byte ASCII character, with the same coding as the General Status, to make its interpretation easy. Depending on the replying message, the *hopper status*es are located in different positions.

The *information data*, when necessary, gives detailed information as required by the corresponding command, like Cassette *ID- numbers*, number of notes dispensed from each hopper, and so on.

The *status codes* itself, both General and Hopper ones, provide the user with several kinds of information:

Successful operation. Hardware problems. Software problems. Operation mistakes Communication problems. Cassette situation.

A detailed analysis of the different *status codes* will be done later on in this manual.

All MultiMech status codes are described in section 5 of this document.

**3.4 Coding of Note Trays**

The MultiMech may operate in one of two modes depending on the setting of data item 251 – Note tray ID source. The modes are “Fixed” and “Tray magnet coded”. When data item 251 is written, note tray data items (size, denomination and cassette code) and note size parameters are cleared for all denominations.

**Fixed Mode**

When ‘Note tray ID source’ is set to ‘0’ the denomination used in each feeder is fixed. When the MultiMech is installed and calibrated each feeder is setup with a single denomination of bank note. The MultMech must be re-calibrated if the denomination in a feeder is to be changed (Write zero to data item 392 to start recalibration.)

**Tray magnet coded mode**

When ‘Note tray ID source’ is set to ‘1’ the denomination loaded into a feeder is determined by the magnet coding on the note tray. When the MultiMech is installed and calibrated each tray may be coded to accept a single denomination and the MultMech must be calibrated with each of the denominations to be used.

**Note tray ID numbers**

Each note tray is identified by a unique ID-number.

Throughout this manual we will be making references to the cassettes ID-NUMBERs and also to the Hopper numbers. It’s extremely important to clearly understand both concepts. The ID- NUMBER is a 5-digit numeric code.

When in “tray magnet coded” mode, more than one note tray can be loaded in the lower CH2 feeder. The move forward (dispense) command requests notes from each feed module by feeder number. Therefore, it will always be necessary to set up a correspondence between each Feeder and the cassette it contains. This is what the Hopper Number is used for.

Each one of the note feeders in the system is defined as a Hopper. Each Hopper will be internally identified by a one-digit code, which will be the Hopper Number. The top feeder will be reported as Hopper Number 1, the second feeder as Hopper Number 2, and so on. Hopper 0 is reported for compatibility with the NMD50 – it

used to be a special reject cassette used for reject notes. The

MultiMech has the reject cassette integrated into the top note tray.

**Assigning ID-numbers to note trays in the MultiMech**

The note tray ID-number is assign to the note tray depending on the setting of data item 251 – Note tray ID source.

When in ‘fixed mode’ the 5 digit ID-number is assigned to each feeder. This number may be set by writing data item 9H28 where H is the hopper number. Currency, denomination and note size information may also be assigned by writing data items 9H27 and

9H29.

When in ‘tray magnet coded’ mode the 5 digit ID-number is assigned to each unique note tray code. There are five note tray codes available, A, D, F, G and R. The installer assigns a note tray code to each denomination to be used.

This ID-number is then assigned for each note tray code. It is set by writing data item 9H28 where H is the hopper number where the note tray is loaded.

Currency, denomination and note size information may also be assigned by writing data items 9H27 and 9H29.

**Note tray magnet codes**

MultiMech uses 4 magnets for identifying the tray code.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Note Tray Code | Magnet Plug Position | | | |
|  | 0 | 1 | 2 | 3 |
| R | 1 | - | - | - |
| A | - | 1 | 1 | 1 |
| D | - | 1 | 0 | 0 |
| F | - | 0 | 1 | 0 |
| G | - | 0 | 0 | 1 |

Denomination code R identifies the top note tray with the reject compartment.

The other note trays are identified by note tray codes A,D,F and G.

**Magnet plug positions on the note tray**



Position 0

1

2

3

**4 COMMAND AND REPLY STRUCTURE**

**4.1 Data transmission**

Communication between the MultiMech and the external network is performed through a standard V.24 port.

As we already have stated, the dialogue procedure is always performed in the same simple way: pairs of COMMAND-REPLY messages. Optionally using the standard V24 timing signals. Detailed information about ASCII character set and signal timing see section 6.

**4.1.1 Message format**

**Commands format**

The commands sent from the network to the MultiMech must conform to the following format:

C DDD...LL E

Where:

|  |  |  |  |
| --- | --- | --- | --- |
| C | = | OPERATION CODE | 1 Byte |
| D | = | DATA | 0-250 Bytes |
| L | = | LRC | 2 Bytes |
| E | = | EOM | 1 Byte |

The Operation Code can be any of the codes we already described in paragraph 3.2. Its length is always one byte.

The DATA Field is only required when using Commands: X’32’ MOVE FORWARD

X’47’ SEND SELF TEST DATA

X’52’ X’44’ READ DATA X’57’ X’44’ WRITE DATA

The LRC Field, Longitudinal Redundancy Check, is always two bytes long. It is used internally to test the accuracy of the received data. How to calculate it, is explained in paragraph 6.5.

The EOM Field is the End of Message indicator, and ASCII <CR>, hexadecimal X’0D’ will be used.

**Status reply format**

The status reply messages sent back to the network from the

MultiMech, will always conform with the following standard format:

S DDD…LL E

Where:

|  |  |  |  |
| --- | --- | --- | --- |
| S | = | STATUS | 1 Byte. |
| D | = | DATA | 0-250 Bytes |
| L | = | LRC | 2 Bytes |
| E | = | EOM | 1 Byte. |

The Status Code is 1 Byte ASCII character, which tells the network what the result of the executed transaction has been. This field is the General Status Code described in paragraph 3.3. The

Particular Status of each hopper comes, when relevant, as part of the DATA Field.

The LRC and EOM Fields have the same values, lengths and meanings of those already explained in the preceding paragraph.

More detailed information about the status codes will be given in

Section 5 of this manual.

**Longitudinal Redundancy Check**

In order to verify the accuracy of all transmitted data, all messages sent to the line, both COMMANDS and STATUS REPLY MESSAGES, must include, before the EOM character, the LRC bytes. These two characters are automatically calculated and included by the Controller in the Status Reply Message sent to the network. It is the responsibility of the network to include them in

the commands sent to the MultiMech.

The LRC is a logical algorithm is explained in section 6.5

**4.2 Commands overview.**

Possible commands available to handle the system are listed below. Each one of the commands is identified by an operation code, 1 byte long, in Hex code. Below follow a list with a full set of commands available and recommended time outs in application program:

OP. CODE MNEMONIC COMMENTS TIME TO EXECUTE

X’30’ RESET Resets some internal registers on the Controller Board, and performs a reject sequence to clear the system

X’32’ MOVE FORWARD Picks up the requested number of notes, moves forward into the Stacker and waits for a new command.

X’35’ READ CASS-ID. Establish which denominations have been loaded in the MultiMech.

180 sec

180 sec

20 sec

X’36’ CHECK DISPENSED NOTES

Check the number of notes that has been delivered to the customer in the latest transaction

5 sec

X’37’ CLOSE CASSETTE Simulated NMD cassette close is performed. Internal

MultiMech NMD emulator is updated. .

X’38’ OPEN CASSETTE Simulated NMD cassettes open is performed. Internal

MultiMech NMD emulator loads note tray parameters.

X’39’ READ REJECT TRACE Sends to the network the Trace Area buffer, in which the system holds the last 15 reject reasons.

5 sec

10 sec

5 sec

X’3A’ CHECK THROAT Tests if there are any notes left in the Delivery Throat. 5 sec

X’41’ READ PROG-ID. Reads the Program Identification Numbers of the software version installed in the MultiMech.

5 sec

X’47’ SEND SELF TEST DATA Performs and reports the result of internal self-test. 20 sec X’4B’ RESEND LAST MESSAGE Resend last reply message. 5 sec X’51’ CHECK NMD STATUS Check the status of the MultiMech 20 sec

X’52’ CLEAR NOTE TRANSPORT Clears the note transport. Works as the Reset command when item 236 is set.

180 sec

X’52’ X’44’ READ DATA Read Data Item 20 sec

X’57’ X’44’ WRITE DATA Write Data Item 20 sec

**4.3 Commands and replies description**

Under this heading, it will be described in full detail, each one of the different commands available for the MultiMech, as well as the different reply messages, which can be sent to the network from the system.

A reference will be made of the different status codes, which can appear in each one of the commands; however, full description of those statuses will be given in Section 5 of this Reference Manual.

In this section there will be references to the following two groups of commands:

**Movement Commands:**

X’30’ RESET

X’32’ MOVE FORWARD X’37’ CLOSE CASSETTE X’38’ OPEN CASSETTE

X’52’ CLEAR NOTE TRANSPORT

**Non-Movement Commands:**

X’35’ READ Cassette-ID

X’39’ READ REJECT TRACE X’41’ READ PROG-ID

X’47’ SEND SELF TEST DATA X’4B’ RESEND LAST MESSAGE X’51’ CHECK NMD STATUS

X’52’ X’44’ READ DATA X’57’ X’44’ WRITE DATA

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**Command X’30’ RESET**

**Command Message String:**

C LL E

Where: C = Command Code, X’30’.

L = LRC

E = EOM Character.

**Reply Message String:**

S HFNNN HFGGGGG ….. LL E ***or*** S LL E

Where: S = General Status Code.

H = Hopper Number.

F = Hopper Status Code.

N = Number of notes rejected during the reset

sequence.

G = Cassette ID-Number. L = LRC

E = EOM Character.

**Notes:** The field HFGGGGG is repeated for each Cassette loaded in the system, except for the Reject Vault/Tray.

The data NNN for HOPPER number X’30’ contains the number of notes counted by the Note Qualifier during the reset sequence. Feed Cassette will have HOPPER numbers X’31’ – X’34’ and the ID-number range from 00001 – 99999.

If S = X’3A’ “CASSETTE NOT PROPERLY INSTALLED” or if S

= X’3F’ “REJECT VAULT NOT PROPERLY INSTALLED” only hoppers with status X’3A’ and/or status X’3F’ will be reported. The Cassette ID-Number will be set to 00000 since it is not possible to read the cassette number in this situation. Other hoppers with cassettes installed cannot be reported until the status is cleared. The second alternative message format (SLLE), will be sent if a LOCKOUT condition occurs. (Refer to Section 5). If only the Reject Vault is inserted X’3A’ is not reported as return code.

Command **X’30’ RESET**

When a fatal error has occurred (See Section 5), the system will only accept either the X’30’ RESET, X’37’ CLOSE CASSETTE or Non-Movement commands. Any other command will cause the MultiMech to send the same fatal status message reply.

The RESET Command is only intended for use after a note jam, lockout or any other fatal error condition. Therefore, it should be used outside of the normal daily operation, in such a way that it is not easy for the operator to issue it without special supervisor authorisation.

It is very important that the note transport path has to be cleared from notes after a jam, before sending this command. Remaining notes in the upper transport path can be delivered through the throat on this command.

If the Reset command is sent without clearing the transport path, the number of remaining notes that are delivered through the throat during a reset command, can be checked with X’36 Check Delivered Notes command.

If item 236 is set the transport speed is limited to

500mm/s. If there is a note in the transport path after the diverter the transport will stop, or not start at all. In this case the return code will be X’68’ Error in note transport. To clear the transport from notes command X’52’ CLEAR NOTE TRANSPORT has to be used.

**Command Time out:**

The recommended time out for this command is 180 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

**Command X’32’ MOVE FORWARD**

**Command Message String:**

C T HDDD HDDD .... LL E

Where: C = Command Code X’32’.

T = Must be X’30’ for normal operation, see note 1 below.

H = Hopper number, X’31’ to X’34’

D = Number of notes to pick up from this hopper

(3 digits). L = LRC

E = EOM Character.

**Reply Message String:**

S HFNNN HFNNN HFNNN ..... LL E ***or*** S LL E

Where: S = General Status Code.

H = Hopper number, X’30’ to X’34’. F = Hopper Status Code.

N = Number of notes fed from this hopper, rejects included.

L = LRC

E = EOM Character.

**Notes:** The field HFNNN is repeated for each hopper dispensed from and / or for each hopper having some relevant information. Hopper number zero will always be the first one. For this hopper, the NNN field contains the total number of notes, which have been passed the Note Qualifier including single rejects. The second alternative message format (SLLE) will be sent if a LOCKOUT condition is present when the command is received. A LOCKOUT condition occurring during execution will report with the first alternative message. The short message format

will also be sent if status code X’37’ TRANSMISSION ERROR, X’38’ ILLEGAL COMMAND or X’4E’ COMMUNICATION TIMEOUT occurs. (Refer to Section 5).

1 Field T accepts a value of ‘9’ to enable the “Dispense to reject” diagnostic mode. This mode should not be used by control applications; it is for internal testing only.

Command **X’32’ MOVE FORWARD**

**Command Description:**

This command picks up the requested number of notes from the specified feed modules and delivers them to the throat. If an error is detected, the note is diverted into the Reject Vault. If a single reject occurs the MultiMech will try to fulfil the requested number of notes from the actual feeder before starting to feed from the next. The reply message includes information about the actual number of notes picked from each Cassette, as well as their

particular status. Hopper number 0 data will show the total number of notes that have passed the Note Qualifier including single rejects. Long notes, doubles are counted as 2. Treble notes or more are counted as 2 notes.

If the reply from the MultiMech is not X’30’ SUCCESSFUL COMMAND, the command X’36’ Check Delivered Notes must be used to check how many notes has been delivered through the throat to the customer. A recommendation is to use the command X’36’ Check Delivered Notes after every Move Forward command.

See description of command X’36’ Check Delivered

Notes.

The command can be issued with all note feeders addressed, but with a total of zero notes requested. All feeders addressed will give a response. Addressed non- existing feeders and feeders without cassettes will answer with status X’3A’ NOTE CASSETTE NOT PRESENT.

If the same command is repeated but notes are requested from at least one feeder non existing feeders and feeders without opened cassettes will answer with status X’30’ SUCCESSFUL COMMAND in the hopper status position.

The default maximum number of notes in a transaction is

50.

(The maximum number of notes in a transaction can be limited with item 104). Requesting more will cause the status X’42’ TOO\_MANY\_NOTES\_REQUESTED to be sent to the network.

If Change over is used (Item 127 is set to 1) the addressed feeders as well as the feeders used to fulfil the transaction will report their status and number of notes picked from each cassette. The addressed feeders that become empty during the transaction will report X’32’ EMPTY CASSETTE as hopper status, but the general status will X’30’ SUCCESSFUL COMMAND or X’31’ LOW LEVEL if the transaction is fulfilled successfully.

**Command Time out:**

The recommended time out for this command is 180 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

Command **X’35’ READ CASSETTE ID**

**Command Message String:**

C LL E

Where: C = Command Code, X’35’.

L = LRC

E = EOM Character.

**Reply Message String:**

S HFGGGGG HFGGGGG ….... LL E ***or*** S LL E

Where: S = General Status Code.

H = Hopper Number, X’30’ TO X’34’ F = Hopper Status Code

G = Cassette ID-Number. L = LRC

E = EOM Character.

**Notes:** The field HFGGGGG is repeated for each Cassette loaded in the system.

The Reject Vault has HOPPER number X’30’ and Note Cassettes will have HOPPER number X’31’ – X’32’ and the ID- number range is from 00001 – 99999.

If S=X’3A’ “CASSETTE NOT PROPERLY INSTALLED” or if S=X’3F’ “REJECT CASSETTE NOT PROPERLY INSTALLED” only hoppers with this status will be reported. The Cassette number reported will be set to 00000 since it is not possible to read the cassette numbers in this situation. Other feeders with cassettes installed cannot be reported until status is cleared. If only the Reject Vault is inserted X’3A’ is not reported as a return code.

The second alternative message format (SLLE), will be sent if status code X’37’ TRANSMISSION ERROR, X’38’ ILLEGAL COMMAND or X’4E’ COMMUNICATION TIMEOUT occurs.

Command **X’35’ READ CASSETTE ID**

**Command Description:**

This command requests the Cassette ID-numbers of all the Cassettes inserted in the MultiMech, including the Reject Vault.

The Reply Message will provide the Application Program with the identification codes of all the Cassettes loaded in the system. Cassette numbers will appear in the natural sequence of the hopper numbers, always beginning with Hopper 0, the Reject Vault. (Further information about Cassette ID-Numbers and HOPPER Numbers; can be found in paragraph 3.4)

This command must be used whenever the Cassettes

HAVE been or COULD HAVE been changed.

In order to avoid any possible misunderstanding about the denomination of the notes loaded in each hopper, the MultiMech does not allow any dispense operation (Command X’32’ MOVE FORWARD) unless this

command has been issued after the X’38’ OPEN CASSETTE Command.

While fatal errors cannot occur during execution of this command, the reply may report a fatal error to indicate that a previous lock out condition has occurred.

**Command Time out:**

The recommended time out for this command is 20 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

**Command X’36’ CHECK DELIVERED NOTES**

**Command Message String:**

C LL E

Where: C = Command Code X’36.

L = LRC

E = EOM Character.

**Reply Message String:**

S HFNNN HFNNN HFNNN ..... LL E ***or*** S LL E

Where: S = General Status Code.

H = Hopper number, X’30’ to X’34’. F = Hopper Status Code.

N = Number of notes delivered from this hopper. L = LRC

E = EOM Character.

**Notes:** The field HFNNN is repeated for each hopper dispensed from and / or for each hopper having some relevant information. Hopper number zero will always be the first one. For this hopper, the NNN field contains the total number of notes which have passed the Throat sensor and delivered to the customer The second alternative message format (SLLE), will be sent if status code X’37’ TRANSMISSION ERROR, X’38’ ILLEGAL COMMAND or X’4E’ COMMUNICATION TIMEOUT occurs.. (Refer to Section 5).

Command **X’36’ CHECK DELIVERED NOTES**

**Command Description:**

This command is used to check the number of notes delivered to the customer through the throat sensor, when the answer on a MOVE FORWARD is not SUCCESSFUL COMMAND.

The command can also be used to check if any notes are delivered through the throat during a Reset command. In the case only the counter for hopper 0 will be presented.

On a power fail the counters for delivered notes are saved in a non-volatile memory.

**Command Time out:**

The recommended time out for this command is 5 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

The use of this command is recommended for the following replies:

|  |  |  |  |
| --- | --- | --- | --- |
| MNEMONIC NAME  Empty Cassette. | TYPE  O | HEX X’32’ | ASCII  2 |
| Diverter Failure | F | X’35’ | 5 |
| Failure to Feed. | R | X’36’ | 6 |
| Transmission Error. | S | X’37’ | 7 |
| Jam in Note Qualifier | F | X’39’ | 9 |
| Jam in Note Feeder Transport | F | X’43’ | C |
| Cassette Data Corrupted | R | X’45’ | E |
| Main Motor Failure. | F | X’46’ | F |
| Note Qualifier Faulty | F | X’49’ | I |
| Note Feeder exit sensor failure | R | X’4A’ | J |
| Communications Time-out. | S | X’4E’ | N |
| Reject Vault Cassette Full. | O | X’51’ | Q |
| Error in Throat. | F | X’57’ | W |
| Sensor Error or Sensor Covered. | R | X’5B’ | [ |
| Internal Failure/Data Corrupted | F | X’60’ | ‘ |
| Error in Note Transport | F | X’68’ | b |

Command **X’37’ CLOSE CASSETTE**

**Command Message String:**

C LL E

Where: C = Command Code, X’37’.

L = LRC

E = EOM Character.

**Reply Message String:**

S LL E

Where: S = General Status Code.

L = LRC

E = EOM Character.

This command simulates an NMD close cassette operation. This command sets the internal state to “machine not opened” and “cassette not identified”.

When note tray magnet codes are NOT in use (data item

251 is 0) this command will clear a reject vault full lock out condition.

(When note tray magnets are being used (data item 251

is 1) the upper tray must be removed and reinserted while the power is on to clear the reject vault full lock out condition.)

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Command **X’38’ OPEN CASSETTE**

**Command Message String:**

C LL E

Where:

C = Command Code, X’38’. L = LRC

E = EOM Character.

**Or**

CHT LL E

Where:

only only

C = Command Code, X’38’.

H = Hopper number, X’31’ to X’34’ T = Open Type:

X’30’ has no affect, for NMD compatibility

X’31’ has no affect, for NMD compatibility

L = LRC

E = EOM Character.

(MultiMech ignores the HT parameters in the send form of the open cassette command and internal processing is the same for both command variants.)

**Reply Message String:**

S LL E

Where:

S = General Status Code. L = LRC

E = EOM Character.

This command simulates an NMD open cassette operation. As part of the execution of this command the note tray parameters serial number, denomination and note sizes are assigned. Data item 251 determines how the parameters are assigned:

Item 251 is 0: preset parameters are allocated to each feeder

Item 251 is 1: parameters are assigned according to the magnet coding on each note tray.

This is a required command in before a move forward command can be sent.

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Command **X’39’ READ REJECT TRACE**

**Command Message String:**

C LL E

Where: C = Command Code, X’39’.

L = LRC

E = EOM Character.

**Reply Message String:**

S RRRRRRRRRRRRRRRR LL E ***or*** S LL E

Where: S = General Status Code.

R = LAST 15 REJECT REASONS:

X’30’ = Pointer or Unused Position. X’31’ = Double Note.

X’32’ = Internal Reject.

X’33’ = Long Note sensor A. X’34’ = Long Note sensor B. X’35’ = Short Note.

X’36’ = Incorrect Count. X’37’ = Thin Note.

X’38’ = Skewed Note. X’39’ = Notes Too Close

L=LRC

E=EOM Character.

**Notes:** The second alternative message, format (SLLE) will be sent if status code X’37’ TRANSMISSION ERROR, X’38’ ILLEGAL COMMAND or X’4E’ COMMUNICATION TIMEOUT occurs.

Command **X’39’ READ REJECT TRACE**

**Command Description:**

This command will request the MultiMech to send back to the Network the contents of the Reject Trace Buffer. This is an area in the memory of the MultiMech Controller, which keeps a record of the last 15 rejects, which took place, during movement commands.

The buffer holds that information coded as described in the Reply Message String, one byte per rejection. The buffer is updated in a circular way, so that it will always contain the last 15 reject causes. One additional byte, containing X’30’ is used as a buffer pointer, indicating that the immediately preceding byte corresponds to the last reject. The content of this buffer is lost when the machine is powered off, so that at the beginning of daily

operations, it is always loaded with 16 zeros (X’30’).

The Application Program may use this command for statistical purposes, and also by the technical service engineer to analyse system performance.

The internal reject reasons showed in item 300 and the translation to external reject reason (MDDM emulation) are in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
| Reject  Code | MultiMech Reject Name | MDDM Reject Name | Description |
| 01 | LEARNING\_NOTE | Internal Reject | Reject reason for the rejected notes in the learning sequence. |
| 02 | MORE\_THAN\_ONE\_NOTE | Double Note | The note was detected as double |
| 03 | TOO\_SKEWED\_NOTE | Skewed Note | The note was too skewed |
| 04 | TOO\_LONG\_NOTE\_AT\_DDA | Long Note sensor A | The note was too long at double detect sensor A. |
| 05 | TOO\_LONG\_NOTE\_AT\_DDB | Long Note sensor B | The note was too long at double detect sensor B. |
| 06 | TOO\_SHORT\_NOTE\_AT\_DDA | Short Note | The note was too short at double detect sensor A. |
| 07 | TOO\_SHORT\_NOTE\_AT\_DDB | Short Note | The note was too short at double detect sensor B. |
| 08 | TOO\_CLOSE\_NOTE | Notes Too Close | The note was too close to previous note. |
| 09 | TRANSACTION\_ABORT | Incorrect Count. | Note that is rejected on a transaction abort due to a fatal status. |
| 10 | UNEXPECTED\_NOTE | Incorrect Count. | A note is seen in the double detect sensor but not by the NF Exit Sensor |
| 11 | NOTE\_IS\_TOO\_THIN | Thin Note | The note was detected as thin. |
| 12 | DIVERTER\_OP\_FAILED | Incorrect Count. | It was not possible to move the diverter from reject to deliver |

13 TOO\_CLOSE\_IN\_TRP Notes Too Close An ok note is too close to the following note. Both notes will be rejected.

Command **X’39’ READ REJECT TRACE**

|  |  |  |  |
| --- | --- | --- | --- |
| Reject  Code | MultiMech Reject Name | MDDM Reject Name | Description |
| 14 | TOO\_CLOSE\_IN\_DIV | Notes Too Close | An ok note is too close to the following note. Both notes will be rejected. |
| 15 | DIVERTER\_OP\_FAILED\_STK | Incorrect Count. | It was not possible to move the diverter from deliver to reject. . |
| 16 | LEARNING\_NOTE\_SINGLE | Internal Reject | Reject reason for the rejected notes in the learning sequence. All notes are rejected. |
| 17 | TEST\_NOTE | Incorrect Count. | Not used. Only for test purpose. |
| 18 | DELAYED\_NOTE | Incorrect Count. | This internal reject reason is used when a note is too late to the Note Qualifier. The reject reason occurs when the timeout exceeds for a note in the NQ. Only used internally for logging reason. |
| 19 | REJECT\_ALL\_NOTE | Internal Reject | Used when a note is fed and rejected during a Close Cassettes command. |
| 20 | OVERLAPPED\_A | Long Note sensor A | Used for reject reason on the second note on two overlapped notes. The note is detected as one long note on channel A, but two separate notes on channel B. |
| 21 | OVERLAPPED\_B | Long Note sensor B | Used for reject reason on the second note on two overlapped notes. The note is detected as one long note on channel B, but two separate notes on channel A. |
| 22 | UNEXPECTED\_IN\_REJ | Incorrect Count. | A note, which has not passed the Note Qualifier, is seen in the reject sensor. |
| 23 | REJECT\_NOTE\_ ON\_COMMAND | Internal Reject | This reject reason occurs on notes that are fed in a test Move Forward command. |
| 24 | REJECT\_IN\_STK | Internal Reject | Not used in MultiMech |

**Command Time out:**

The recommended time out for this command is 5 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

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**Command X’3A’ CHECK THROAT**

**At the time of writing (firmware version 2012-01.02), the CHECK THROAT command is not supported. It is a planed future enhancement.**

**Command Message String:**

C LL E

Where: C = Command Code, X’3A’.

L = LRC

E = EOM Character.

**Reply Message String:**

S LL E

Where: S = General Status Code.

L = LRC

E = EOM Character.

Command **X’3A’ CHECK THROAT**

**Command Description:**

This command can be used to check if there are notes remaining in the throat.

The Reply Message will only answer X’4D’ Notes In Throat if the notes are still in the Throat sensor or X’30’ Successful Command if there are no notes in the throat.

**Command Time out:**

The recommended time out for this command is 5 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

Command **X’41’ READ PROGRAM-ID**

**Command Message String:**

C LL E

Where: C = Command Code, X’41’.

L = LRC

E = EOM Character.

**Reply Message String:**

S M NNNNNNNN LL E ***or*** S LL E

Where: S = General Status Code.

M = Unit Identifier, always X’44’

N = Program ID-Number, 8 bytes. L = LRC

E = EOM Character.

**Notes:** The second alternative message format (SLLE) will be sent if status code X’37’ TRANSMISSION ERROR, X’38’ ILLEGAL COMMAND or X’4E’ COMMUNICATION TIMEOUT occurs.

Command **X’41’ READ PROGRAM-ID**

**Command Description:**

This command requests the MultiMech to send back to the network a reply containing the Software Identification Number. This will be sent in the Reply Message, in the format of 8 ASCII numeric characters, preceded by the letter D.

Program ID for all controllers in the MultiMech can be read with Read Data Item 100.

**Command Time out:**

The recommended time out for this command is 5 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

Command **X’47’ SEND SELFTEST DATA**

**At the time of writing (firmware version 2012-01.02), the following definition of send self test data is incomplete. The format of the command is the same as the NMD50 definition but some fields have different uses.**

**Command Message String:**

C H LL E

Where:

C = Command Code, X’47’. H = Hopper number.

L = LRC bytes.

E = EOM character.

**Reply Message String:**

The reply message format depends on hopper number specified:

|  |  |  |  |
| --- | --- | --- | --- |
| H | = | ”1”-”4” | S TTTTTTTTTTTUUUUUUVVVHHHCCCDDDI LL E |
| H | = | ”9” | S TTTUU LL E |
| H | = | ”A” | S TUUUCCCDDDIAAAaNNNBBBbNNN....... |

.....CCCDDDIAAAaNNNBBBbNNN LL E

***or***

S LL E

Where:

S = General Status Code.

A = Double detect sensor A offset. A = Double detect sensor A gain

B = Double detect sensor B offset. B = Double detect sensor B gain

C = Currency code

D = Denomination code

E = Offset calibration sensor A F = Offset calibration sensor B H = Horizontal size of note

I = Note type/Issue.

N = Sensor nominal note thicknes value

T = Sensor test data.

U = Sensor calibration value. V = Vertical size of note.

L = LRC bytes.

E = EOM Character.

**Notes:** The last alternative message format will be sent if status X’37’ TRANSMISSION ERROR, X’38’ ILLEGAL COMMAND or X’4E’ COMMUNICATION TIMEOUT occurs.

Command **X’47’ SEND SELFTEST DATA**

When hopper number is set to 1 or 2 the Note Feeders and Note Cassettes are addressed, the reply message will contain information of the following sensors and switches: The sensors labelled with “T” above will also report status X’5B’ if an error associated to the sensor detected. When the NC is not present the positions related to the cassette will be reported as ”-”.

The format of the reply is similar to the NMD50 reply when NMD50 data item 214 is set to ‘1’. MultiMech does not use data item 214.

**S TTTTTTTTTTTUUUUUUVVVHHHCCCDDDI LL E**

Currency CCC = Currency code DDD = Denomination code I=Type

Note size VVV = vertical size HHH = horizontal size

Note tray denomination code [ ”?” =unknown ”R”,”A”,”D”,”F” or ”G” Not used

Not used

Exit sensor calibration value [ ”0” ≤ D ≤ ”21 ”] Not used

Not used

Not used

Cassette low level sensor [”0” = Low level, ”1” = Not low level]

Cassette present sensor [ ”0” = Cassette not present ”1” = Cassette present]

Tray magnet sensor 0 or 1

Tray magnet sensor 2

Tray magnet sensor 3

Not used

Not used

Exit sensor [”0” = Sensor not obstructed, ”1” = Sensor obstructed ]

Command **X’47’ SEND SELFTEST DATA**

When hopper number set to ”9” the Note Transport is addressed in the command, the reply message will

contain information of the following sensors and switches:

**S TTTTT LL E**

Throat sensor calibration value [ ”0” ≤ D ≤ ”7” ]

Note Transport sensor calibration value [ ”0” ≤ D ≤ ”7 ”]

Reject Vault present sensor [ ”0” = Cassette not present ”1” = Cassette present]

Throat sensor [”0” = Sensor not obstructed, ”1” = Sensor obstructed

”2” =Sensor error ”3” = Sensor warning]

Note Transport sensor [”0” = Sensor not obstructed, ”1” = Sensor obstructed

”2” =Sensor error ”3” = Sensor warning]

Command **X’47’ SEND SELF TEST DATA**

When hopper number set to ”A” the Note Qualifier Module is addressed, the reply message will contain information

of the transport clock sensor and double detect sensors. The note specific data will be repeated for up to 10 latest used currencies and denominations. Unused entries will be reported as ”-” (X’2D’):

**S TUUUCCCDDDIAAAaNNNBBBbNNN.... CCCDDDIAAAaNNNBBBbNNN LL E**

Sensor B nominal note thicknes value [ ”000” ” ≤ D ≤ ”999”] Sensor B gain [”0” ≤ D ≤ ”7” ]

Sensor B offset [ ”000” ” ≤ D ≤ ”999”]

Sensor A nominal note thicknes value [ ”000” ” ≤ D ≤ ”999”] Sensor A gain [”0” ≤ D ≤ ”7” ]

Sensor A offset [ ”000” ” ≤ D ≤ ”999”] Type/Issue

Denomination code

Currency code

Transport clock sensor calibration value [”000” ≤ D ≤ ”200”]

Transport clock sensor [”0” = Sensor not obstructed, ”1” = Sensor obstructed ]

**Command Time out:**

The recommended time out for this command is 20 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

Command **X’4B’ RESEND LAST MESSAGE**

**Command Message String:**

C LL E

Where: C = Command code X’4B’.

L = LRC Bytes

E = EOM character.

**Reply Message String:**

S M…LL E ***or*** S LL E

Where: S = General Status Code.

M = Last Response Message. L = LRC Bytes.

E = EOM Character.

**Notes:** The M-parameter Last Response Message will contain an exact copy of last message sent with the exception that the LRC and EOM characters are removed.

The second alternative message format (SLLE) will be sent if an error exists at the MultiMech controller or if the following status occurs.

X’37’ TRANSMISSION ERROR, X’38’ ILLEGAL COMMAND,

X‘4E’ COMMUNICATION TIMEOUT or

X‘65‘ NO MESSAGE TO RESEND.

Command **X’4B’ RESEND LAST MESSAGE**

**Command Description:**

This command causes the MultiMech controller to resend the last response message sent, excluding the response on this command it self.

The command is primarily intended to be used after a communication error is detected in the response message.

If there is no response message to resend, i.e. no command has been executed since power on/hardware reset, the status code X’65’ NO MESSAGE TO RESEND will be sent using the second alternative reply message format.

The general status in the reply message shows the validity of the response.

**Command Time out:**

The recommended time out for this command is 5 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

Command **X’51’ CHECK NMD STATUS**

**At the time of writing (firmware version 2012-01.02), the following definition of CHECK NMD STATUS has not been updated to describe how the command works on the MultiMech. This description is for the NMD 50.**

**Command Message String:**

C LL E

Where: C = Command Code, X’51’.

L = LRC

E = EOM Character.

**Reply Message String:**

S HFArrGGGGG HFAffGGGGG ….... ttqqdds sppoovvLL E

***or***

S LL E

Where: S = General Status Code.

H = Hopper Number, X’30’ TO X’38’ F = Hopper Status Code

A = Cassette Open Close status

rr = Internal status for Reject Vault ff = Internal status for Feeder

tt = Internal status for Main motor drive

qq= Internal status for Note Qualifier (Double

Detect)

dd= Internal status for Note Diverter ss = Internal status for Note Transport pp=

oo= Internal status for Note Output (Throat)

vv= Internal status for Data Handler(Used for

cassette items)

G = Cassette ID-Number. L = LRC

E = EOM Character.

**Notes:** The field HFAffGGGGG is repeated for eight feeder positions for compatibility with the NMD. The MultiMech has only two feeder positions.

The Reject Vault have HOPPER number X’30’ and Note Cassettes will have HOPPER number X’31’ – X’38’ and the ID- number range is from 00001 – 99999.

The second alternative message format (SLLE), will be sent if status code X’37’ TRANSMISSION ERROR, X’38’ ILLEGAL COMMAND or X’4E’ COMMUNICATION TIMEOUT occurs.

Command **X’51’ CHECK NMD STATUS**

**Command Description:**

This command requests the Cassette ID-numbers of all the Cassettes inserted in the NMD

**Description of Cassette Open / Close Status (‘A’)**

|  |  |
| --- | --- |
| Cassette Open / Close Status field ‘A’ | Meaning |
| 0 | No Feeder at position |
| 1 | No Cassette Inserted |
| 2 | Cassette Inserted |
| 5 | Cassette opened in operation position |

Command **X’51’ CHECK NMD STATUS**

**The internal statuses (rr, qq, dd etc) are described below. The internal statuses are also used in item**

**311.**

**The internal failure codes for the Reject Vault:**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Name of internal Failure | Description |
| rr | 01 | REJ\_CASS\_ALMOST\_FULL | The RV is almost full |
|  | 02 | REJ\_CASS\_FULL | Not Used in the MultiMech |
|  | 03 | REJ\_NO\_CASS\_IN\_MODULE | There is no RV inserted |
|  | 04 | REJ\_STACK\_REJECT\_ERROR | Not Used in the MultiMech |
|  | 05 | REJ\_CLOSE\_ERROR | Not Used in the MultiMech |
|  | 06 | REJ\_SINGLE\_ACCEPT\_ERROR | Not Used in the MultiMech |
|  | 07 | REJ\_STACK\_ACCEPT\_ERROR | Not Used in the MultiMech |
|  | 08 | REJ\_CASS\_DATA\_ERROR | Not Used in the MultiMech |
|  | 09 | REJ\_JAM\_IN\_QUA | Not Used in the MultiMech |
|  | 10 | REJ\_NOTE\_JAMMED | Not Used in the MultiMech |
|  | 11 | REJ\_NOTE\_IN\_STK | Not Used in the MultiMech |
|  | 12 | REJ\_COM\_ERROR | Not Used in the MultiMech |
|  | 13 | REJ\_SW\_FAILURE | Not Used |
|  | 14 | REJ\_FATAL\_SW\_FAILURE | Not Used |

Command **X’51’ CHECK NMD STATUS**

**The internal failure codes for the Note Feeder Task:**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Name of internal Failure | Description |
| ff | 01 | FDR\_NO\_CASS\_IN\_MODULE | There is no cassette in the actual feeder position |
|  | 02 | FDR\_SERVICE\_REQUEST | Service requested on the actual feeder. |
|  | 03 | FDR\_CASS\_ALMOST\_EMPTY | Low level in the cassette |
|  | 04 | FDR\_EMPTY\_DETECTED\_ NOT\_LOW | Empty has been detected without having low level in the cassette |
|  | 05 | FDR\_EMPTY\_DETECTED\_ LOW | Empty has been detected with low level in the cassette |
|  | 06 | FDR\_EMPTY\_CHANGE\_OVER | Empty has been detected, but the feeding continues from another feeder |
|  | 07 | FDR\_CASS\_EMPTY | The cassette is marked as empty. |
|  | 08 | FDR\_FEED\_ERROR | The feeder has not been able to feed the notes. |
|  | 09 | FDR\_RETRY\_NOTE | The feeding is interrupted due to a possible jam between the feeder and the Note Qualifier. A retry is made on this error. |
|  | 10 | FDR\_SENSOR\_ERROR | A sensor is faulty, or a note is stuck under the exit sensor |
|  | 11 | FDR\_ABORT\_ERROR | The feeding is aborted because the RV is full during the transaction. |
|  | 12 | FDR\_RETRY\_TRANS | Not Used in the MultiMech |
|  | 13 | FDR\_CASS\_LOCK\_ERROR | Not Used in the MultiMech |
|  | 14 | FDR\_COM\_CLOSE\_ERROR | Not Used in the MultiMech |
|  | 15 | FDR\_COM\_ERROR | Not Used in the MultiMech |
|  | 16 | FDR\_SW\_FAILURE | Not Used in the MultiMech |
|  | 17 | FDR\_FATAL\_SW\_FAILURE | Not Used in the MultiMech |

Command **X’51’ CHECK NMD STATUS**

**The internal failure codes for the main motor transport task:**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Name of internal Failure | Description |
| tt | 01 | TRP\_MISSING\_PULSE | Transport clock pulses are missed, probably due to dust on the transport clock sensor. |
|  | 02 | TRP\_MOTOR\_START\_ FAILURE | The main motor transport did not reach the stipulated speed within a timeout. |
|  | 03 | TRP\_MOTOR\_SPEED\_TOO\_ LOW | The speed is lower than the speed tolerance, probably due to a jam in the transport path |
|  | 04 | TRP\_MOTOR\_SPEED\_TOO\_ HIGH | The speed is higher than the speed tolerance. |
|  | 05 | TRP\_SW\_FAILURE | It was not possible to access the main motor transport from a task. Another task has the access to main motor transport. |
|  | 06 | TRP\_FATAL\_SW\_FAILURE | It was not possible to create mailboxes and queues; the task will not start at all. |

Command **X’51’ CHECK NMD STATUS**

**The internal failure codes for the Note Qualifier task**

**(double detect):**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Name of internal Failure | Description |
| qq | 01 | QUA\_CONFIG\_DATA\_ERROR | An error in the note data table was detected during power on. All notes have to be learned again. |
|  | 02 | QUA\_WRITE\_E2\_ERROR | An error was detected when writing the note data table to the e2prom. |
|  | 03 | QUA\_TOO\_MANY\_REJECTS | More than five rejects without any OK notes between. |
|  | 04 | QUA\_JAM\_NOTE\_ TRANSPORT | A note has left the Note Feeder exit sensor and is not seen in the Double detect sensors. |
|  | 05 | QUA\_CHECK\_FAILURE | An error was detected, when an ongoing calibration was made on the Double detect sensors.  The error is cleared if the next ongoing calibration is successful. |
|  | 06 | QUA\_LEARNING\_FAILURE | An error was detected during learning sequence. It was not possible to adjust the gain enough. The note was either too thick for the lowest gain value or too thin for the highest gain value. |
|  | 07 | QUA\_CALIBRATE\_FAILURE | An error was detected, when a calibration from a command was made on the Double detect sensors. |
|  | 08 | QUA\_LID\_OPENED | The lid in the Note Qualifier is detected as opened. |
|  | 09 | QUA\_SW\_FAILURE | It was not possible to access the qualifier a task, |
|  | 10 | QUA\_FATAL\_SW\_FAILURE | It was not possible to create mailboxes and queues; the task will not start at all. |

Command **X’51’ CHECK NMD STATUS**

**The internal failure codes for the Note Diverter task:**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Name of internal Failure | Description |
| dd | 01 | DIV\_SENSOR\_ERROR | It was not possible to calibrate the Note Transport Path sensor. The sensor is located in the note path after the note diverter. The reason for this error could be a faulty sensor, or that the sensor is covered with a note. |
|  | 02 | DIV\_SW\_FAILURE |  |
|  | 03 | DIV\_FATAL\_SW\_FAILURE | Not used |

**The internal failure codes for the Note Stacker task, in the NMD 50 this task handles the Note Transport Sensor:**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Name of internal Failure | Description |
| ss | 01 | STK\_UNEXPECTED\_NOTE | Not Used in the NMD 50 |
|  | 02 | STK\_ENABLE\_ERROR | . |
|  | 03 | STK\_JAM\_IN\_QUA | A note has jammed between the Note Qualifier and the Note Transport path sensor |
|  | 04 | STK\_NOTE\_JAMMED | Not used in the NMD 50. |
|  | 05 | STK\_PATH\_NOTE\_JAMMED | A note has jammed under the  Note Transport Path sensor. |
|  | 06 | STK\_NOTE\_IN\_REJ | Not used in the NMD 50. |
|  | 07 | STK\_MOVEMENT\_ERROR | Not used in the NMD 50. |
|  | 08 | STK\_SW\_FAILURE | Not used |
|  | 09 | STK\_FATAL\_SW\_FAILURE | It was not possible to create mailboxes and queues; the task will not start at all. |

Command **X’51’ CHECK NMD STATUS**

**The internal failure codes for the Throat output (oo)**

**.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Cod e** | **No** | **Name of internal Failure** | **Description** |
| oo | 01 | THR\_SENSOR\_ERROR | It was not possible to calibrate the Throat sensor. The reason for this error could be a broken sensor, or that the sensor is covered with a note. |
|  | 02 | THR\_NOTE\_JAMMED | The note has jammed between the Note transport Path sensor and the Throat sensor. |
|  | 03 | THR\_NOTE\_IN\_THROAT | The note has jammed under the  Throat sensor. |
|  | 04 | THR\_SW\_FAILURE | Not Used |
|  | 05 | THR\_FATAL\_SW\_FAILURE | It was not possible to create semaphores; the task will not start at all. |

Command **X’51’ CHECK NMD STATUS**

**The internal failure codes for the Data Handler**

|  |  |  |  |
| --- | --- | --- | --- |
| **Cod e** | **No** | **Name of internal Failure** | **Description** |
| vv | 01 | DAT\_CASS\_DATA\_ERROR | There was a checksum error in the cassette data area. |
|  | 02 | DAT\_CASS\_COMM\_ERROR | Communication error with the cassette. |
|  | 03 | DAT\_SW\_FAILURE | It was not possible to access the cassettes. Another task has the access to the cassettes. |
|  | 04 | DAT\_FATAL\_SW\_FAILURE | It was not possible to create semaphores; the task will not start at all. |

Fatal errors can not occur on this command, only remaining fatal errors that has occurred in a previous command are reported

**Command Time out:**

The recommended time out for this command is 20 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

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**Command X’52’ CLEAR NOTE TRANSPORT**

**Command Message String:**

C LL E

Where: C = Command Code, X’52’.

L = LRC

E = EOM Character.

**Reply Message String:**

S HFNNN HFGGGGG ….. LL E ***or*** S LL E

Where: S = General Status Code.

H = Hopper Number.

F = Hopper Status Code.

N = Number of notes rejected during the reset

sequence.

G = Cassette ID-Number. L = LRC

E = EOM Character.

**Notes:** The field HFGGGGG is repeated for each Cassette loaded in the system, except for the Reject Vault/Tray.

The data NNN for HOPPER number X’30’ contains the number of notes counted by the Note Qualifier during the reset sequence. Feed Cassette will have HOPPER numbers X’31’ – X’34’ and the ID-number range from 00001 – 99999.

If S = X’3A’ “CASSETTE NOT PROPERLY INSTALLED” or if S

= X’3F’ “REJECT VAULT NOT PROPERLY INSTALLED” only hoppers with status X’3A’ and/or status X’3F’ will be reported. The Cassette ID-Number will be set to 00000 since it is not possible to read the cassette number in this situation. Other hoppers with cassettes installed cannot be reported until the status is cleared. The second alternative message format (SLLE), will be sent if a LOCKOUT condition occurs. (Refer to Section 5). If only the Reject Vault is inserted X’3A’ is not reported as return code.

Command **X’52’ CLEAR NOTE TRANSPORT**

This command is used to clear the note transport path when item 236 is set.

The command works similar the X’30’ Reset command and shall only be used as a service command. If a fatal error occurs on the first X’52’ command, a second X’52’ command has to be sent.

**Command Time out:**

The recommended time out for this command is 180 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

Command **X’52’X’44’ READ DATA**

**Command Message String:**

CC d nnnn LL E

CC d nnnn d ccc LL E

CC d nnnn d cccmmet LL E

Where:

C = Command Code ”RD”. d = Delimiter X’2F’ “/”.

Ccc = Currency identifier (mandatory for some item numbers, see below)

cccmmet = Currency, denomination and type identifier

(mandatory for some items)

nnnn = Item number. L = LRC Bytes.

E = EOM Character.

**Reply Message String:**

S d DDD… LL E*OR* S LL E

Where:

S = General Status Code. D = Delimiter X’2F’ “/”.

D = Data read from requested item

D = Delimiter X’2F’ “/”. L = LRC bytes.

E = EOM Character.

**Notes:** The second alternative message formats (SLLE) will be sent if an error exists at the MultiMech controller or if following status occurs.

X’37’ TRANSMISSION ERROR, X’38’ ILLEGAL COMMAND,

X‘4E’ COMMUNICATION TIMEOUT.

**Command Time out:**

The recommended time out for this command is 5 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

Command **X’52’X’44’ READ DATA**

This command is used to read data to the MultiMech internal data structures. The following section contains a more detailed description of the read data items.

The items supported are:

**Item Access Description**

100 R Program ID

104 R Max. notes per bundle

110 R Machine ID

118 R Currency codes

202 R Note sizes

211 R Status on Non Addressed Feeders

236 R Check Notes in transport

251 R Tray ID source

252 R Handshake mode

300 R Reject counter 300

301 R Status counter 301

303 R Dispense counter (trip)

304 R Reject counter (trip)

305 R Zero reply

308 R Total notes single rejected

309 R Zero reply

318 R Zero reply

319 R Zero reply

320 R Number of transactions started (trip)

330 R Dispense counter (life)

331 R Reject counter (life)

332 R Zero reply

333 R Number of transactions started (life)

334 R Zero reply

390 R Zero reply

395 R Enable/Disable Reject Vault

397 R Module Status

399 R Maximum number of notes in the reject compartment (full limit)

600 R Deliver retries

601 R Feed retries

602 R Pick retries

609 R Deliver retries when tray is low

9H27 R Currency and Denomination

9H28 R Cassette ID

9H29 R Note size

Command **X’57’X’44’ WRITE DATA**

**Command Message String:**

CC d nnnn LL E

CC d nnnn d ccc LL E

CC d nnnn d cccmmet LL E

Where:

C = Command Code ”WD”. D = Delimiter X’2F’ “/”.

Ccc = Currency identifier (mandatory for some item numbers, see below)

cccmmet = Currency, denomination and type identifier

(mandatory for some items)

nnnn = Item number. L = LRC Bytes.

E = EOM Character.

**Reply Message String:**

S LL E

Where:

S = General Status Code. L = LRC bytes.

E = EOM Character.

**Command Time out:**

The recommended time out for this command is 5 seconds.

**Status Codes:**

Table 5-1 shows a cross-reference picture of the different status codes.

Command **X’57’X’44’ WRITE DATA**

This command is used to write data to the MultiMech internal data structures. The following section contains a more detailed description of the write data items.

The items supported are:

**Item Access Description**

104 W Max. notes per bundle

110 W Machine ID

211 W

236 W Check Notes in transport

237 W

251 W Tray ID source

252 W Handshake mode

310 W Clear reject counters, error log and trip counters

392 W NQ Note data table initialisation

395 W Enable/Disable Reject Vault

399 W Maximum number of notes in the reject compartment (full limit)

9H27 W Currency and Denomination

9H28 W Cassette ID

9H29 W Note size

**READ/WRITE DATA ITEMS DESCRIPTION**

Item Item name

Read

/

write

Field length

Description

100 Program

ID block

R 231 Program versions.

CMCxxxxyyzzSPCxxxxyyzzNF1xxxxyyzz... NF8xxxxyyzzNC1xxxxyyzz... NC8xxxxyyzzNSUxxxxyyzz RVCxxxxyyzzPARxxxxyyzz

The version number after “PAR”, is the version of a parameter file, which contains special currency depending settings.

104 Max. notes per dispense

R/W 3 Maximum number of notes in one dispense

Legal values: 1 – 50.

110 Machine

ID

118 Currency codes

R/W <21 Write ID: *WD/110/<module><id>* Read ID block: *RD/110/<block>/* Where module is “MMB” and “id” is 14 characters.

Block is “0” to the read the MMB field. A block value of 1,2 or 3 will reply “0/” (where “0” is the general status byte).

R 8 \* 3 Currency codes.

This is a string containing the currency codes (3 characters) of the defined currencies. Undefined currencies are marked as ‘*---*‘.

202 Note sizes R 8 \*13 Description of all notes sizes.

Format: ”cccmmetvvvhhh”

211 Status on Non Addressed Feeders

R/W 1 ‘0’: No status on Non-addressed feeders

(default).

‘1’: Status on Non-addressed feeders or for that has some relevant information.

236 Check Notes in Transport

R/W 1 When this item is set, no notes will be delivered through the exit on a Reset command.

‘0’ Disabled (default)

‘1’ Enabled

**READ/WRITE DATA ITEMS DESCRIPTION**

236 Check Notes in

Transport

237 Default Machine settings

R/W 1 When this item is set, no notes will be delivered through the exit on a Reset command.

‘0’ Disabled (default)

‘1’ Enabled

W 1 WD/237/1 sets all machine settings to default.

A power off power on has to be made before the default machine settings are actual.

251 Note tray ID source R/W 1 Used to determine how the MultiMech implements tray denomination coding.

0 = no tray ID. The denomination used in each feeder must not change since the feeder implies the denomination is use. Feeder 1 has denomination “1”, feeder 2 has denomination “2”, etc.

1 = use magnets on tray. The tray magnets identify which denomination is fitted. The top feeder is always denomination “R”. The other feeders read the tray code using the tray magnets. The trays may be coded as A, D, F, G.

**If ‘Note tray ID source’ is changed the MultiMech must be recalibrated and the note tray data items Cassette ID, denominations and size must be reset..**

252 Handshake mode R/W 1 MultiMech must be rebooted after this

item or the RS232 cable type is changed for the change to take affect. Determines how handshaking works

0=auto depending on RS232 cable wiring. MultiMech will automatically detect which mode to use for an RS232 connection, USB will operate with handshaking.

1=force off, MultiMech ignores handshake lines.

2=force on, MultiMech always uses handshake lines.

**READ/WRITE DATA ITEMS DESCRIPTION**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 300 | Internal reject table | R | 25\*5 | This table specifies the number of |
|  | | | | times each reject reason has |
| occurred. This item contains 25 |
| entries.  Format: RRnnn.... |

*R*: Reject reason code

*nnn*: Number of occurrence of the reject reason.

This item can be called with *‘ccmmet’* parameter, to get the reject reason counters for one denomination. Reject reason counters for the last ten denominations are stored.

It can also be called with parameter 1 to 8 to get the reject reasons for each feeder.

301 Status code table R 40\*5 This table specifies the number of times each status code has occurred. This item contains 40 entries. Status X’30’ is not logged.

Format: SSnnnSSnnn

SS: Status code

Nnn: Number of occurrence of the status code

303 Total notes delivered R 10 Total number of notes delivered.

304 Total notes rejected R 10 Total number of notes rejected.

305 Zero reply R 10 For compatibility with test programs

308 Total notes single rejected

R 10 Total number of notes rejected with single rejects

309 Zero reply R 10 For compatibility with test programs

310 Clear Note statistic counters

W 1 ‘0’: Clear the contents of item 300,

301, 303, 304, 309, 318, 319 and

320.

318 Zero reply R 10 For compatibility with test programs

319 Zero reply R 10 For compatibility with test programs

READ/WRITE DATA ITEMS DESCRIPTION

320 Total number of transactions

R 10 Total number of transactions completed.

330 Total notes delivered

(Life Long)

R 10 Total number of notes delivered.

331 Total notes rejected

(Life Long)

R 10 Total number of notes rejected.

332 Zero reply R 10 For compatibility with test programs

333 Total number of transactions bundles (Life Long)

R 10 Total number of transactions completed.

334 Zero reply R 10 For compatibility with test programs

390 Zero reply R 10 For compatibility with test programs

392 NQ Note data table initialisation

395 Enable/Disable

Reject Vault

W 1 ‘0’: Clears the NQ Note data table.

R/W 1 '0': Disable Reject Vault

'1': Enable Reject Vault (Default)

397 Module Status R 12\*9 Specifies status of modules.

TTT/EE/LLLL/ Where:

TTT = task

EE = module error code

LLLL = module line number

399 Max notes in the

Reject Vault

R/W 3 Specifies the maximum number of notes in the reject compartment Legal values: 1 - 40 (Default=20) **Warning**: A high value could cause jams in the Reject Vault inlet.

600 Deliver retries RW 2 Number of times the feed note algorithm runs when trying to feed a note

601 Feed retries R 2 Multiply these two values together to get the number of pick attempts in each deliver attempt (item 600)

602 Pick retries R 2

609 Deliver retries when the tray is low

RW 2 Number of times the feed note algorithm runs when trying to feed a note when the tray is low

9H2

7

9H2

8

9H2

9

Currency and Denomination Cassette ID

Note size

**READ/WRITE DATA ITEMS DESCRIPTION**

The cassette table consists of data related to each cassette present in the MultiMech.

All cassette data table item numbers are written on the following format:

9H*nn*

9 specifies the data table.

H specifies the position of the cassette, where 0=Reject vault, 1=Cassette in first Feeder and 4=Cassette in last Feeder.

**Changing currency and denomination**

use the command **WD/9H27/cccmmet**.

ccc = Currency code according to DIN 30784 and ISO 4217.

When a note not included in ISO 4217 is used the currency code should be set to **?xx,** where **xx** is a Talaris recommended code for the specific note.

**mm** = Is the mantissa, the mantissa should coded with as low value as possible, i.e. the exponent should be as high as possible, the most significant digit should be ”0” for all currencies not needing two digits to describe the value.

**e** = Is the number of trailing zeros

**t** = Is the Variant/Issue, **t** is a letter code where ”A” is the first Issue/Variant in circulation, ”B” the second and so on. If the variant is not needed or not used the code should be set to ”\_”.

**Ex.** The cassette is inserted in NF1, the note to be used is a 20 US Dollar Franc of the first issue/variant. The command is:

**WD/9127/USD021**

ccc mm e t

A Dutch 25 Gelder note of issue/variant B in NF2 gives in the same way the Command:

**WD/9227/NLG250B**

ccc mm e t

**Changing the Cassette ID**

Use the command WD/9H28/XXXXXXXX

**XXX**XXXXX The three most significant digits are recommended to be coded with 000 when used in mechanisms emulating a MDDM

XXX**XXXXX** The five least significant digits are the five-digit number reported in the response to the Reset and Read Cassette ID commands. The coding of these five digits is totally transparent to the dispensing mechanism.

Note

If the mechanism is used with an Application program written for the MDDM/SD300 it’s recommended that this eight digits is used in the following way:

000**10052**

Not used always 000

Denomination code

Cassette Identification

Use digits 0 to 5 for denomination coding with the lowest digit for the lowest denomination. Reserve code

6 for the reject vault.

**Changing Note size (Note width and length)**

Use command WD/9H29/vvvhhh

**vvv**hhh = Vertical size of note (width) in mm vvv**hhh** = Horizontal size of note (length) in mm

**Verifying cassette coding**

All coding can be read out by using command Read Data. **RD/9H27**, **RD/9H28** and **RD/9H29**. As with Write the variable H addresses the location in the mechanism.

The reply string will have the format S/YYY…Y where S is the general status code and YYY…Y is the actual setting with the same format as Write Data.

**Ex.** Read currency and denomination in NF4 the note is a

10 000 Italian Lira of third variant/issue:

Command:

**RD/9427**

Reply: **0/ITL015C**

General

Currency Denomination Variant C

status

code

code

10 000

Length

Width

**5 STATUS HANDLING**

**5.1 Introduction**

This Section describes in detail each individual status code sent back to the network by the MultiMech.

Each one of the Status Codes, will be provided with following information:

Status Code. Mnemonic name. Status Description. Applicable Commands.

Recommended Actions. Recommended Operator Message.

Table 5-1 shows all the possible Status Codes, with the

Mnemonic

Names used throughout this Section, and their different types, which will be

described in the following paragraph.



X’30 X’32 X’35 X'36 X’37 X’38 X’39 X’3A X’41 X’47 X’4B X'51 X’52 X'52 X'57

Reset

Move Forward

Read Cassette Id.

Check Delivered Notes

Close Cassette

Opens Cassette

Read Trace

Check Throat

Read Prog Id

Send Self Test Data

Resend Message

Check NMD Status

Clear Note Transport

Read Data

Write Data

X'44 X'44

0 2 5 6 7 8 9 : A G K Q 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Successful Command. | **X'30'** | 0 | A | A | A | A | B | B | B | B | B | B | B | A | A | B | B |
| Low Level. | **X'31'** | 1 | A | A | A |  |  |  |  |  |  |  |  | A | A |  |  |
| Empty Cassette. | **X'32'** | 2 | A | A | A |  |  |  |  |  |  |  |  | A | A |  |  |
| Machine not Opened. | **X'33'** | 3 |  | B |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Rejected Notes. | **X'34'** | 4 |  | B |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Diverter Failure | **X'35'** | 5 | B | B | B |  | B | B |  |  |  |  |  | B | B |  |  |
| Failure to Feed. | **X'36'** | 6 |  | A |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Transmission Error. | **X'37'** | 7 | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B |
| Illeg Com. or Com. Seq. | **X'38'** | 8 | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B |
| Jam in Note Qualifier | **X'39'** | 9 | B | B | B |  | B | B |  |  |  |  |  | B | B |  |  |
| NCNot Pres or Prop Ins. | **X'3A'** | : |  | A | A |  |  |  |  |  |  | A |  |  |  | B | B |
| RV Not Pres or Prop Ins. | **X'3F'** | ? | A | A | A |  | B | B |  |  |  |  |  | A | A |  |  |
| Too Many Notes Req. | **X'42'** | B |  | B |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Jam in Note Feeder Transport | **X'43'** | C | B | B | B |  | B | B |  |  |  |  |  | B | B |  |  |
| Reject Vault Almost Full. | **X'44'** | D | A | A | A |  |  | B |  |  |  |  |  | A | A |  |  |
| Cassette Internal Failure | **X'45'** | E | A |  | A |  |  | B |  |  |  |  |  | A | A | B | B |
| Main Motor Failure. | **X'46'** | F | B | B | B |  | B | B |  |  |  |  |  | B | B |  |  |
| Note Qualifier Faulty | **X'49'** | I | B | B | B |  | B | B |  |  |  |  |  | B | B |  |  |
| NF exit sensor failure | **X'4A'** | J | A | A | A |  |  |  |  |  |  | A |  | A | A |  |  |
| Notes in Delivery Throat | **X'4D'** | M |  | B |  |  |  |  |  | B |  |  |  |  |  |  |  |
| Communications Time-out. | **X'4E'** | N | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B |
| Cassette not Identified. | **X'50'** | P |  | B |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Reject Vault Full. | **X'51'** | Q | B | B | B |  |  | B |  |  |  |  |  | B | B |  |  |
| Error in Throat. | **X'57'** | W | B | B | B |  | B | B |  |  |  |  |  | B | B |  |  |
| Sensor Err or Sensor Cover. | **X'5B'** | [ | B | B |  |  |  | B |  |  |  | B |  | B | B |  |  |
| NMDInternal Failure | **X'60'** | ‘ | B | B | B | B | B | B |  |  |  |  |  | B | B | B | B |
| Cassette Lock Faulty | **X'61'** | a |  |  | A |  |  | B |  |  |  |  |  | A |  |  |  |
| Module Need Service | **X'63'** | c | A | A | A |  |  | B |  |  |  |  |  | A | A |  |  |
| No Message To Resend. | **X'65'** | e |  |  |  |  |  |  |  |  |  |  | B |  |  |  |  |
| Err in Note Transport | **x'68** | h | B | B | B |  | B | B |  |  |  |  |  |  | B |  |  |

Table 5-1

**Notes:**

A = This Status can appear as General Status and as Hopper Status

B = This Status appears only as General Status.

Table 5-1 shows all the possible Status Codes, with the Mnemonic Names used throughout this Section, and their different types, which will be described in the following paragraph.

Status codes

**Table 5-2**

|  |  |  |  |
| --- | --- | --- | --- |
| MNEMONIC NAME | TYPE | HEX | ASCII |
| Successful Command | W | X’30’ | 0 |
| Low Level | W | X’31’ | 1 |
| Empty Cassette | O | X’32’ | 2 |
| Machine not Opened | O | X’33’ | 3 |
| Rejected Notes | W | X’34’ | 4 |
| Diverter Failure | F | X’35’ | 5 |
| Failure to Feed | R | X’36’ | 6 |
| Transmission Error | S | X’37’ | 7 |
| Illegal Command or Command Sequence | S | X’38’ | 8 |
| Jam in Note Qualifier  Feed Cassette Not Present or Properly Installed Reject Vault Not Present or Properly Installed Too Many Notes Requested  Jam in Note Feeder Transport  Reject Vault Almost Full | F O O O F W | X’39’ X’3A’ X’3F’ X’42’ X’43’ X’44’ | 9  :  ? B C D |
| Main Motor Failure  Note Qualifier Faulty  Note Feeder exit sensor failure  Notes in Delivery Throat | F F R O | X’46’ X’49’ X’4A’ X’4D’ | F I J  M |
| Communications Time-out Cassette not Identified Reject Vault Full | S S O | X’4E’ X’50’ X’51’ | N P Q |
| Error in Throat | F | X’57’ | W |
| Sensor Error or Sensor Covered  Internal Failure | R F | X’5B’ X’60’ | [  ‘ |
| Module Need Service  No Message To Resend | W W | X’63’ X’65’ | c e |
| Error in Note Transport | F | X’68 | h |

**5.2 Status types**

The different Status Codes sent back to the network in the Reply Message are classified into five different groups, depending on the priority level of the reported situation.

Each one of these groups will imply a different action for the Application Program handling them. The five groups, and the status included under each one of them, are:

**5.2.1 WARNING Status (Type W)**

The status codes under this heading give the operator some information about the system, which does not require any immediate action. The requested command has been completed.

The statuses of type W are:

|  |  |  |
| --- | --- | --- |
| X’30’ | = | Successful Command |
| X’31’ | = | Low Level |
| X’34’ | = | Rejected Notes |
| X’44’ | = | Reject Vault Almost Full |
| X’47’ | = | Rejected Cheque |
| X’63’ | = | Module Need Service |

**5.2.2 SOFT RECOVERABLE Status (Type S)**

All the status codes under this heading will inform the Application Program that the associated command has not been executed. However, there is not any hardware failure in the machine, so that it in most cases would be possible to send the last command again, and if the same status remains, check the Application Program and/or check the communication line.

They are:

|  |  |  |
| --- | --- | --- |
| X’37’ | = | Transmission Error |
| X’38’ | = | Illegal Command or Command Sequence |
| X’4E’ | = | Communications Time-out |
| X’50’ | = | Cassette not Identified |

**5.2.3 OPERATOR RECOVERABLE Status (Type O)**

Like the status codes of the preceding group, these status codes also imply that the associated command has not been executed. There could be different reasons, but all of them could be easily solved by

an operator action, like refilling an empty Cassettes or sending

OPEN CASSETTE command.

The statuses included in this group are:

|  |  |  |
| --- | --- | --- |
| X’32’ | = | Empty Cassette |
| X’33’ | = | Machine not Opened |
| X’3A’ | = | Note Cassette Not Present or Properly Installed |
| X’3F’ | = | Reject Vault Not Present or Properly Installed |
| X’42’ | = | Too Many Notes Requested |
| X’4D’ | = | Notes in Delivery Throat |
| X’51’ | = | Reject Vault Full |

**5.2.4 RETRIABLE FATAL Status (Type R)**

The status codes included in this group will probably imply a hardware failure. The associated command is not executed at all, but could be tried again. If the status code is repeated after this second try, the system should be taken out of service.

The following statuses are included in this group:

|  |  |  |
| --- | --- | --- |
| X’36’ | = | Failure to Feed |
| X’45’ | = | Cassette Internal Failure |
| X’4A’ | = | Feeder Sensor Fail. |
| X’5B’ | = | Sensor Error or Sensor Covered |
| X’65’ | = | No Message To Resend |

**5.2.5 FATAL Status (Type F)**

The status codes defined as Fatal imply a serious problem. The associated command has not been completed and the execution was terminated at the stage where the fatal problem was detected. The MultiMech will respond to all movement commands with the same fatal error status until appropriate action has been taken. Please refer to special fatal status until appropriate action has been taken.

The FATAL Statuses are divided into two severity types and the action to be taken depends on which type the received status belongs to.

The application may send an X’30’ RESET command to recover from the problem. If the Status appears again the system must be put out of service, until a Field Service Engineer has revised it.

The Statuses of this type are:

|  |  |  |
| --- | --- | --- |
| X’46’ | = | Main Motor Failure |
| X’49’ | = | Note Qualifier Faulty |
| X’60’ | = | Internal Failure |
| X’61’ | = | Cassette Lock Faulty |

The MultiMech must be put out of service, until a Field Service

Engineer has revised it.

The Statuses of this type are:

|  |  |  |
| --- | --- | --- |
| X’35’ | = | Diverter Failure |
| X’39’ | = | Jam in Note Qualifier |
| X’43’ | = | Jam in Note Feeder Transport |
| X’57’ | = | Error in Throat |
| X’68’ | = | Error in Note Transport |

**5.2.6 Lock out conditions**

Under certain circumstances, the system sets itself in the LOCK OUT condition. When this happens, all the Reply Messages of movement commands are sent in the short format, containing only the General Status byte, until the LOCK OUT condition is cleared. Meanwhile, only very few commands are accepted by the system.

There can be different reasons that put the machine into the LOCK OUT state. Each one of the LOCK OUT conditions are explained below with the ways of recovery and also the commands which are not accepted during this LOCK OUT condition.

**Machine not opened**

When all cassettes are closed, after a power-up or a hardware reset, the LOCK OUT condition is set. Issuing the command X

‘38’ OPEN CASSETTE clears the condition. The following commands are not accepted during the LOCK OUT condition:

X’32’ MOVE FORWARD

**Cassettes not identified**

When the cassettes are opened operating position, the LOCK OUT condition is set. Issuing the command X ‘35’ READ CASSETTE-ID clears the condition.

The following commands are not accepted during the LOCK OUT

condition:

X’32’ MOVE FORWARD

**Reject Vault full**

When the limit for number of rejected notes has been exceeded for the Reject Vault, the system stays in LOCK OUT condition until the Reject Vault is removed and emptied. WITH THE POWER ON The only movement commands accepted are:

X’37’ CLOSE CASSETTE

**Fatal jam**

All the status codes defined as fatal will cause this LOCK OUT condition. In this situation, the only movement commands acceptable are:

X’30’ RESET

X’37’ CLOSE CASSETTE

**Status description**

Included in the following pages, are detailed descriptions of each one of the

different status codes that can appear in the Reply Messages from the

MultiMech Controller to the Network.

Each status can be easily identified by its mnemonic name, and also by its

ASCII code. The different statuses are described in the natural sequence of their hexadecimal values.

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**SUCCESSFUL COMMAND** STATUS **X’30’**

*TYPE W*

**Status Description:**

This status is sent to the Network, when the command has been successfully executed.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

No action is required.

**Operator Message:**

There is no recommended message for this status.

**LOW LEVEL** STATUS **X’31’**

*TYPE W*

**Status Description:**

This status is sent to the network when the number of notes in one or more Cassettes is below a pre set level. This means that the low-level sensor in the Note Cassette has been activated. This happens when the number of notes left in the cassette represents a note pile of less than 20-30 mm

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The Cassettes should be removed and filled using the normal procedure. The refilling could be delayed for several transaction since this status is a first warning that the cassette is becoming empty and the Cassette still contains notes for several transactions. But actions should be taken to refill the cassette as soon as possible.

This message could also indicate for the Application Program to use alternate Cassette in the following transaction.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

31-W LOW LEVEL IN CASSETTE NNNNN

**EMPTY CASSETTE** STATUS **X’32’**

*TYPE O*

**Status Description:**

This status is generated when a Cassette is empty during a dispense operation. For compatibility reasons Empty cassette is only reported when notes are requested from the cassette that is empty, Empty cassettes not requested in the Move Forward command will have their hopper status set to Low Level. On the commands Reset and Read cassette ID X’35’ cassettes with empty condition will reply with X’32’ EMPTY CASSETTE in the Reply

Message for the cassettes that are empty.

If Change Over Method is used (item 127 set to 1), X’32’ EMPTY CASSETTE will be reported as hopper status on the cassettes that become empty during the transaction, but the overall status will be X’31’ LOW LEVEL or X’34’ REJECTED NOTES if the transaction is successfully performed.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The empty Cassette should be removed and refilled using the normal loading procedures. The status could also be used to trigger the Application Program to begin using alternate note Cassettes in the following transactions.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

32-O CASSETTE NUMBER NNNNN IS EMPTY

**MACHINE NOT OPENED** Status **X’33’**

*Type O*

**Status Description:**

This status code arises when the cassettes are not opened and any movement command different from OPEN CASSETTE, RESET and CLOSE CASSETTE are sent to the system.

It is also possible that this status is sent to the network, even if the cassettes are opened. This will occur if the machine is switched off and on during normal daily operation. This is to indicate that the power has been off.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

Whatever the cause of this status, it can be easily cleared sending the

commands OPEN CASSETTE and READ CASSETTE - ID.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

33-O MACHINE NOT OPENED

**REJECTED NOTES** Status **X’34’**

*Type W*

**Status Description:**

This status indicates that notes have been rejected during the transaction.

The Reply Message informs of the total number of notes fed from each module, including those rejected. Hopper number 0 field, will detail the total number of notes counted in the Note Qualifier, both delivered and rejected.

Rejection counters in the Application Program can be updated by subtracting the total number of notes requested from the total number of notes counted in the Note Qualifier. However, it must be kept in mind that this figure might be not exact, because rejected notes can be anything from two notes stuck together to a sheet of paper.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

Being a warning message, the only action required is to provide the

Application Program with the proper subroutines to keep control of the number of rejected notes. The reject trace area should be read and the latest reject reason is stored by the application in a maintenance log file.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

34-W CAUTION: NOTES REJECTED

**NOTE DIVERTER FAILURE** Status **X’35’**

*Type F*

**Status Description:**

This status indicates that the system has recognised a note that was intended to be rejected in the Note Transport sensor. The most likely reason is either a mechanical or an electrical failure in the Note Diverter. Therefore it is qualified as Fatal Error.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The contents of the machine has to be verified, all transaction must be suspended, and the system must be taken out of service until checked by a Field Service Engineer. However, to empty the machine of notes a CLOSE CASSETTE command could be sent and the cassettes could be removed.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

35-F NOTE DIVERTER FAILURE. \*\*CALL SERVICE ENGINEER\*\*

**FAILURE TO FEED** Status **X’36’**

*Type R*

**Status Description:**

This status appears when the system fails to dispense the requested amount of notes.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

There could be different reasons to report this status. One reason is that the Note Feeder fails to feed notes; another is that there is too many reject events in the transaction. However, it is not a Fatal Status, the Application Program could try *one* more time. If the situation still remains the same, put the hopper position out of service, continue to feed notes from remaining positions and call for a Field Service Engineer.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

36-R FAILURE TO FEED. \*\*CONTINUE OPERATION FROM REMAINING FEEDER POSITIONS \*\*

**TRANSMISSION ERROR** Status **X’37’**

*Type S*

**Status Description:**

This status occurs when the message received by the MultiMech may be inaccurate. The reason for this status is the detection of a wrong LRC Character or a parity error. Therefore, the cause of the problem may be either some error in the Application Program Subroutines dealing with LRC calculation or a problem in the communication line.

See also chapter 6.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The Application Program could try to send the command, again because the problem might have arisen because of a random noise in the line.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

37-S TRANSMISSION ERROR

**ILLEGAL COMMAND OR COMMAND SEQUENCE** Status **X’38’** *Type S*

**Status Description:**

This error can appear if an unknown command is sent to the MultiMech, or if a command with incorrect parameters is sent to the MultiMech.

**Applicable Commands:**

See table 5-1

Recommended Actions: Please check the application.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

38-S ILLEGAL COMMAND.

**JAM IN NOTE QUALIFIER** Status **X’39’**

*Type F*

**Status Description:**

This status indicates that a note is detected in the Note

Qualifier with a length exceeding 900mm.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

A reset command may clear this condition if it was caused by a stream feed. If a reset command does not clear the condition or if the problem recurs after the reset

command, all transactions must be suspended and the system must be taken out of service until checked by a Field Service Engineer.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

39-F JAM IN NOTE QUALIFIER \*\*CALL SERVICE ENGINEER\*\*

**FEED CASSETTE NOT PRESENT OR OPENED** Status **X’3A’** *Type O*

**Status Description:**

This status appears when requesting notes from a note tray, which is not present, not properly inserted or has an invalid magnet code. This status also appears as Hopper Status.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The operator should remove and re-insert the note tray, read cassette numbers and resume transactions. If the problem remains, check that the magnet coding plugs are fitted correctly.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

3A-O RE-INSERT NOTE TRAY NN AND START UP AGAIN

**REJECT VAULT NOT PRESENT OR OPENED** Status **X’3F’**

*Type O*

**Status Description:**

Whenever a movement command is received, the system checks that the Reject Vault is properly loaded in the machine. If not, this status code is sent, and the transaction is ignored. Only exception is the movement command CLOSE CASSETTE, which will be done without the reject cycle.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The operator should insert the Reject Vault properly and resume daily transactions.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

3F-O INSERT REJECT VAULT

**TOO MANY NOTES REQUESTED** Status **X’42’**

*Type O*

**Status Description:**

This status appears when a transaction with too many notes is requested. Maximum number of notes is default

50, but can be redefined with item 104. The transaction is not executed, and the status code is sent back to the network.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The operator should repeat the transaction, asking for a legal number of notes.

It is recommended that the Application program is checked, while this status indicates that the number of notes requested is higher than the maximum number of notes defined in item 104.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

42-O MORE THAN NNN NOTES REQUESTED

**JAM IN NOTE FEEDER TRANSPORT** Status **X’43’**

*Type F*

**Status Description:**

This status is sent when a note is fed from the feeder, but not reached the Note Qualifier in time. The failure could appear if a jam occurs between the feeder and the Note Qualifier, or if the note is not detected in the Note Qualifier.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The application program should send a RESET command. If the response on the RESET command indicates successful execution, operation can be resumed from the point where the problem occurred. If the problem returns or if the RESET command was unsuccessful the system must be put out of service until checked by a Field Service Engineer.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

43-F JAM IN NOTE TRANSPORT. \*\*CALL SERVICE ENGINEER\*\*

**Note:** The text **\*\*CALL SERVICE ENGINEER\*\*** should not be reported before the recovery procedure has failed.

**REJECT VAULT ALMOST FULL** Status **X’44’**

*Type W*

**Status Description:**

This status is sent, both as General and as Hopper status, when the internal reject counter reaches the limit for

almost full.

The counter for single reject is incremented by one for each rejected note. The limit for almost full in single reject area is 15.

The limit for REJECT VAULT FULL can be set between 1 and 40 with item 399. The limit for REJECT VAULT ALMOST FULL is 75% of the limit for REJECT VAULT FULL.

Example: If item 399 is set to 20, REJECT VAULT ALMOST FULL occurs when the counter for rejects exceeds 15.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The Reject Vault should be emptied as soon as possible to avoid a LOCK OUT condition when the counter for rejected notes is above 15. THE REJECT VAULT MUST BE EMPTIED WITH POWER ON

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

44-W REJECT VAULT MUST BE EMPTIED

**CASSETTE INTERNAL FAILURE Status X’45’**

***Type R***

**Status Description:**

This status is sent if there is a checksum error in the data stored in the Note Cassette.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

Put Cassette out of service.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

43-R CASSETTE INTERNAL FAILURE

**MAIN MOTOR FAILURE** Status **X’46’**

*Type F*

**Status Description:**

This status occurs when main motor has not reached the normal speed in time, or if there are several missing pulses from the transport clock wheel in one transaction. As with any other fatal error, this status code generates a LOCK OUT condition, and the command is not executed.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The application program should send a RESET command. If the response of the RESET command indicates successful execution operation can be resumed from the point where the problem occurred. If the problem returns or if the RESET command was unsuccessful the system must be put out of service until checked by a Field Service Engineer.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

46-F MAIN MOTOR FAILURE \*\* CALL SERVICE ENGINEER\*\*

**Note:** The text **\*\*CALL SERVICE ENGINEER\*\*** should not be reported before the recovery procedure has failed.

**NOTE QUALIFIER FAULTY Status X’49’**

***Type F***

**Status Description:**

This status is sent back to the network from the MultiMech, when it is not possible to calibrate the double detects sensors in the Note Qualifier, or when it is not possible to adjust the gain value when learning a new note. Being a fatal error, the transaction is not completed, and a LOCK OUT condition is generated.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The application program should send a RESET command. If the response on the RESET command indicates successful execution, operation can be resumed from the point where the problem occurred. If the problem returns or if the RESET command was unsuccessful the system must be put out of service until checked by a Field Service Engineer.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

49-F NOTE QUALIFIER FAULTY \*\*CALL SERVICE ENGINEER\*\*

**Note:** The text **\*\*CALL SERVICE ENGINEER\*\*** should not be reported before the recovery procedure has failed.

**NOTE FEEDER SENSOR FAIL** Status **X’4A’**

*Type R*

**Status Description:**

This status appears when a sensor error occurs in the Note Feeder, or when a note is stuck in the Note Feeder exit sensor. This error is qualified as Retriable because the system can still be used if no notes are going to be required from that module.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The Application Program can make a retry with the same command as used when the problem occurred. If the problem still remains, the Application Program must internally mark the particular Hopper as faulty to avoid using it until a Field Service Engineer has resolved the problem.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

4A-R NOTE FEEDER SENSOR FAIL \*\*CALL SERVICE ENGINEER\*\*

**NOTES IN DELIVERY THROAT** Status **X’4D’**

*Type O*

**Status Description:**

An attempt to feed or dispense notes when a note is still in the Throat will cause this error to be sent back as a reply and the command will not be executed.

This status is also used as a throat status in the command

CHECK THROAT.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

If a note is blocking the throat, the note must be removed. Check if notes have been removed, using the command CHECK THROAT, and then repeat the original command.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

4D-O NOTES IN THROAT. TRANSACTION CANCELLED

**COMMUNICATION TIME-OUT** Status **X’4E’**

*Type S*

**Status Description:**

This error status is reported when the transmission of each one of the characters in the command string, is not completed within the time restriction imposed by the electrical interface used. See also chapter 6.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The cause of this problem may be the setting up of the electrical signals in the interface, or an error in the Application Program, which is delaying the transmission of the characters in the command string.

In both cases, the system must be put out of service, and a full revision of the installation and Application Program will be required.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

4E-S COMMUNICATION TIME-OUT. REVISE INSTALLATION

**CASSETTES NOT IDENTIFIED** Status **X’50’**

*Type S*

**Status Description:**

This status is reported when a movement command is ordered without one preceding READ CASSETTE ID command after the cassettes have been opened.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

Either the operator or the Application Program itself should send the READ CASSETTE-ID Command to recover from the LOCK OUT condition.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

50-S CASSETTES NUMBERS MUST BE READ NOW

**REJECT VAULT FULL** Status **X’51’**

*Type O*

**Status Description:**

This status is generated when the internal counter

exceeds 50. See description of REJECT VAULT ALMOST FULL.

It must be kept in mind that this status, even if it is not a fatal one, will

cause a LOCK OUT condition which will not be removed until the Reject Vault has been emptied. The internal counter of rejected notes is stored non-volatile during power down and restored at power up. This means that the Reject Vault MUST BE REMOVED, EMPTIED AND RE-INSERTED WITH THE POWER ON to reset the internal reject counter to 0.

Please refer to status X’44’ REJECT VAULT ALMOST FULL for information about the way the internal reject counters are updated.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The operator must empty and reinsert the Reject Vault before normal operation can be resumed.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

51-O EMPTY AND REINSERT REJECT VAULT

**ERROR IN THROAT** Status **X’57’**

*Type F*

**Status Description:**

This status is reported by the MultiMech when a note is stuck in the throat sensor during Move Forward or Reset Command.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The contents of the machine has to be verified, all transaction must be suspended, and the system must be taken out of service until checked by a Field Service Engineer. However, to empty the machine of notes a CLOSE CASSETTE command could be sent and the cassettes could be removed.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

57-F ERROR IN THROAT \*\*CALL SERVICE ENGINEER\*\*

**SENSOR ERROR OR SENSOR COVERED** Status **X’5B’**

*Type R*

**Status Description:**

This status is used when a sensor in the Note Transport does not work properly during an internal self-test preceding the movement commands.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

When this status is given as reply, the application could make a retry on the command to see if the error still remains. If the error still remains the machine should be checked by a technical service engineer. The sensor may be dirty, have a loose connection or covered by a note.

To check which sensor is affected command X’47’ Send

Self test Data can be used.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

5B-R ERROR IN SENSOR \*\*CALL SERVICE ENGINEER\*\*

**NMD INTERNAL FAILURE** Status **X’60’**

*Type F*

**Status Description:**

This status is reported when an internal error occurs in the MultiMech. The most likely reason for this is internal communication problems in the MultiMech.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

The application program should send a RESET command. If the response to the RESET command indicates successful execution, operation can be resumed from the point where the problem occurred. If the problem returns or if the RESET command was unsuccessful the system must be put out of service until checked by a Field Service Engineer.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

60-F INTERNAL FAILURE \*\*CALL SERVICE ENGINEER\*\*

**Note:** The text \*\*CALL SERVICE ENGINEER\*\* should not be reported before the recovery procedure has failed.

**MODULE NEEDS SERVICE** Status **X’63’** *Type W*

**Status Description:**

This status is reported by the MultiMech when calibration values for at least one sensor in any Note Feeder exceeds the warning level

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

Check the sensor calibration values with SEND SELF TEST DATA command. If the calibration value on one or more sensors is too high maintenance should be carried out.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

63-W MODULE NEED SERVICE

**NO MESSAGE TO RESEND** Status **X’65’**

*Type W*

**Status Description:**

This status appears at the RESEND LAST MESSAGE command when there is no command previously executed and consequently no response message to resend. This status indicates that a power loss/firmware restart has occurred at the MultiMech controller and no information could be retrieved.

**Applicable Commands:**

See table 5-1

**Recommended Actions:**

If the Network has sent the command MOVE FORWARD and this status occurs after receiving command RESEND LAST MESSAGE, special actions must be taken. To see

if any notes have been delivered to the exit, the command CHECK DELIVERED NOTES should be used to verify if the Move Forward was completed.

**Operator Message:**

There is no special recommended message for this status, as the message to send to the operator depends on the command given prior to the RESEND LAST MESSAGE.

**ERROR IN NOTE TRANSPORT** Status **X’68’**

*Type F*

**Status Description:**

This status appears in the following situations: When a note is stuck in the Note Transport sensor. When a note is stuck between the Note Transport sensor and the Throat sensor.

**Applicable Commands:**

See table 5-1.(1).

**Recommended Actions:**

The content of the machine has to be verified, all transaction must be suspended, the system must be taken out of service until checked by a Field Service Engineer. However, to empty the machine of notes a CLOSE CASSETTES command could be sent and the cassettes could be removed. Before sending RESET the Note Transport has to be cleared of notes.

**Operator Message:**

The recommended message that the Application Program should send to the operator is:

62-F ERROR IN NOTE TRANSPORT

62-F \*\* CALL SERVICE ENGINEER\*\*

**6 STANDARD INTERFACE**

The MultiMech Controller Board CMC is equipped with 3 communication ports but only 1 may be used at a time.

• Port 1: 5 pin amp CT compatible with the NMD50 communications connector

• Port 2: 9 way D type connector (connects to a PC

using a serial extension cable)

• Port 3: USB connector (PC driver required)

**6.1 Electrical and mechanical characteristics**

In the following text the logical state "ON" is referred to as active and the logical state "OFF" as inactive.

All interface signals meets the electrical specification of CCITT recommendation V.24 and EIA RS-232-C in asynchronous mode, with

1 START BIT, 7 DATA BITS and 2 STOP BITS,

Signals: Data Signals Logical "1" : below -3 V Logical "0" : above +3 V

C ontrol Signals "OFF" = logical "0" : below -3 V "ON" = logical "1" : above +3 V

Voltages are in reference to signal ground.

**6.2 Baud-rate and parity**

Communication with the MultiMech takes place at a fixed baud rate of 9600 with even parity.

**6.3 Interface signals**

The following signals are defined in the MultiMech application command port 1:

Circuit

CCITT EIA PIN IN/OUT Signal name

103 BA 1 OUT TxD Transmit Data

104 BB 2 IN RxD Receive Data

105 CA 3 OUT RTS Request to Send

106 CB 4 IN CTS Clear to Send

102 AB 5 - SG Signal Ground

**6.4 Character coding**

The MultiMech uses ISO 646 character coding

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **0** |  |  | S  P | 0 | @ | P | ‘ | p |
| **1** |  |  | ! | 1 | A | Q | a | q |
| **2** |  |  | ” | 2 | B | R | b | r |
| **3** |  |  | # | 3 | C | S | c | s |
| **4** |  |  | $ | 4 | D | T | d | t |
| **5** |  |  | % | 5 | E | U | e | u |
| **6** |  |  | & | 6 | F | V | f | v |
| **7** |  |  | ´ | 7 | G | W | g | w |
| **8** |  |  | ( | 8 | H | X | h | x |
| **9** |  |  | ) | 9 | I | Y | i | y |
| **A** |  |  | \* | : | J | Z | j | z |
| **B** |  |  | + | ; | K | [ | k | { |
| **C** |  |  | , | < | L | \ | l | | |
| **D** |  |  | - | = | M | ] | m | } |
| **E** |  |  | . | > | N | ^ | n | ~ |
| **F** |  |  | / | US | O | \_ | o |  |

Table 6.01.(1): Standard ASCII code set

|  |  |  |
| --- | --- | --- |
| NUL DLE | | |
| SOH |  | DC1 |
| STX |  | DC2 |
| ETX |  | DC3 |
| EOT |  | DC4 |
| ENQ |  | NAK |
| ACK |  | SYN |
| BEL |  | ETB |
| BS |  | CAN |
| HT |  | EM |
| LF |  | SUB |
| VT |  | ESC |
| FF |  | FS |
| CR |  | GS |
| SO |  | RS |
| SI |  |  |

**6.5 LRC calculation**

**Example**: If the message string, before the LRC

calculation is: A B C D

Each graphic symbol being a byte of the message string. Then, the following operations should be performed:

• Calculate the "exclusive or" of all the characters in the string: V = (A) .XOR. (B) .XOR. (C) .XOR. (D)

• Divide the hexadecimal value calculated above by hexadecimal 10, and truncate the result:

• Y = V / X’10’

• Calculate the "logical and" between the result of the first operation and the hexadecimal (0F):

• Z = V.AND.X’0F’

• Add hexadecimal (30) to the last two values. This will give us the two

LRC bytes, L1 and L2:

• L1 =Y.OR.X’30’

• L2 =Z.OR.X’30’

• The complete message string without the EOM character, will be: A B C D L1 L2 NOTE:".XOR."=LOGICAL EXCLUSIVE OR. ".AND.=LOGICAL AND ".OR."=LOGICAL OR

• **Example:** A Move Forward command with 5-notes from hopper 2 "202005"

Calculating the exclusive or V= X’32’ .XOR. X’30’

.XOR. X’32’ .XOR. X’30’ .XOR. X’30’ .XOR. X’35’ = X’05’ Divide by X’10:

Y = INT ( X’05’ / X’10’ ) = X’00’ Calculate "logical and".V.AND.X’0F’ Z = X’05’.AND.X’0F’ = X’05’

Add hexadecimal 30 to Y and Z

L1 = X’30’.OR.X’00 = X’30’

L2 = X’30’.OR.X’05’ = X’35’

This will give the complete string

X’31’ X’30’ X’32’ X’30’ X’30’ X’35’ X’30’ X’35’ X’0D’

or expressed as a literal string

"20200505<CR>"

*Pseudo code;* LRC calculation

**a** Set a byte variable to zero. SUM := 0x00

**b** XOR all bytes in the command string FOR i :=

1 to end-of-string

with SUM (NOT including EOM). SUM := SUM XOR CMD[i]

**c** Integer divide SUM with 0x10 and

OR it with 0x30 to get LRC1. LRC1:= (SUM DIV

0x10) OR0x30

**d** AND SUM with 0x0F and OR it

with 0x30 to get LRC2. LRC2 := (SUM AND

0x0F) OR 0x30

**6.5.1 Control signals and cables**

There are two different communication modes for communicating with the MultiMech - with or without "handshaking".

The handshaking mode can be preset using data item 252.

|  |  |
| --- | --- |
| Data item 252 | Operation |
| 0 | (factory setting)  Auto detect using RS232 port cable wiring  USB port operates with handshaking |
| 1 | Without handshake |
| 2 | With handshake |

When data item 252 is set to 0 handshaking mode is be detected automatically depending on the wiring of the RS232 communication cable. The “automatic detection” works by looking to see whether CTS and RTS are linked.

The automatic detection is performed at power up. To change the mode using automatic detection the power must be cycled.

Two cables are available that can control the MultiMech via the 5 pin RS232 port (NMD50 compatible).

A008721 CABLE - RS232 COM HANDSHAKE A008726 CABLE - RS232 COM NO HANDSHAKE

**6.5.2 Communication with handshake**

In normal situations, when handshaking is required, the control signals are used in the following way:

|  |  |
| --- | --- |
| CTS | "ON" condition indicates that the connected device wants to communicate with the MultiMech . The CTS signal must be held "ON" when the command is transmitted to the MultiMech as well as when the MultiMech sends the reply string.  The CTS signal can be used to delay characters in the response message up to 1 sec.  The CTS must be set ”OFF” within 1 sec. after that RTS  has been set ”OFF” by the MultiMech. |
| RTS | "ON" condition will be applied by the MultiMech as a response to detecting the CTS ”ON”. The connected device must not transmit any data to the MultiMech until RTS is "ON". The RTS signal will stay "ON" until the MultiMech has transmitted the response message. |

**Mu ltiM ech**

5-pin fem ale

CT con necto r

AM P p/n 173 977-5

**PC**

DB-9 fem ale connector

T xD 1

RxD 2

RTS 3

CTS 4

SG 5

1 DC D

2 Rx D

3 Tx D

4 DT R

5 SG

6 DSR

7 RTS

8 CTS

9 RI

**Normal situation**

In the normal situation, the Network raises the RTS line, which indicates that it wants to send a message to the MultiMech. In response the MultiMech raises the CTS line within 10 ms, indicating it is ready to receive the first character.

The Network sends the message terminated by an EOM Character; the Network may after sending the EOM Character put the RTS line "OFF". When the message is received by the MultiMech, it is passed onwards to the actual handler in the MultiMech software. When the message has been processed and the MultiMech is ready to send a response the RTS line must be "ON". The Network may now delay the transmission by setting the RTS line "OFF", and re-enable transmission by setting the RTS line "ON" again. The transmission must not be delayed by more than 1 second each time the RTS is turned "OFF".

The MultiMech will terminate the message with an EOM Character. At this point a complete exchange has been performed. The Network now has a choice of two actions.

It may drop RTS, which terminates the connection and causes the MultiMech to drop CTS and resume idle mode.

It may send a new message within 1 second, in which case this is treated in the same manner as the previous.

**Delaying transmission**

The Network may delay transmitted characters from the MultiMech by taking RTS to "OFF" condition. The MultiMech will stop transmission within

2 characters time after that the RTS is set to "OFF" condition.

Maximum delay is 1 second. If exceeded, the error handling described in paragraph 6.08.c below is carried out.

**6.5.3 Error conditions**

After error detection and handling has taken place as described below, the MultiMech will always await a new transmission (command) from the connecting device.

**Receive time out of incoming data**

A 1s timer is started when the MultiMech responses to the handshake and sets CTS signal to "ON". This timer is restarted each time a complete character is received, and is stopped upon receiving an EOM Character.

If a time out occurs, the following error handling takes place:

The MultiMech transmits error message X'4E' COMMUNICATION TIME OUT and then sets CTS to "OFF" condition.

If the RTS is at "OFF" condition when the MultiMech is ready to send the error message, the MultiMech will wait

1 second for RTS "ON" and then set the CTS to "OFF" condition, not sending the error message. The MultiMech will not support any further communication on this channel until the Network sets RTS to ”OFF”.

**Input buffer overflow and receive error**

If the 254 character input buffer is exceeded or a character receive error is detected, such as Parity, Framing or LRC error, the following error handling takes place:

The MultiMech transmits error message X'37' TRANSMISSION ERROR and then sets RTS to "OFF" condition.

If the RTS is at "OFF" condition when the MultiMech is ready to send the error message, the NMD will wait 1 second for RTS "ON" and then set the RTS to "OFF" condition, not sending the error message. The MultiMech will not support any further communication on this channel until the Network sets RTS to ”OFF”.

**Transmit time out / Delay time out**

When the MultiMech is ready to send the response message the RTS line must be "ON" within 1 second. During transmission the RTS line from the Network is used to inhibit the MultiMech if the Network cannot receive data in the rate it is sent to it. When the Network lowers the RTS, the MultiMech stops transmission within

2 characters. The RTS must be raised within 1 second or a transmission time out is triggered. Thus for each character to be sent, the RTS must be raised within 1 second, and when it is lowered, transmission is stopped.

The first character of the response may not be sent before

50 ms have elapsed since reception of the command.

If a transmission time out exception is raised, this causes the MultiMech to lower the CTS signal. The Network must now lower the RTS line before this channel can be used again. There is no time out waiting for the Network to lower the RTS line.

**6.5.4 Communication without handshake**

When "handshaking" is not desired, the control signals may be used in the following way:

|  |  |
| --- | --- |
| CTS | Wired to RTS. The MultiMech Machine controller will at power on reset determine if this pin is connected directly to RTS to deside if communication without hanshake is requested. |
| RTS | Will be set permanently ”ON” after detection of it being wired to CTS |

**NMD**

5-pin female

CT connector

AMP p/n 173 977-5

**PC**

DB-9 female connector

TxD 1

RxD 2

RTS 3

CTS 4

SG 5

1 DCD

2 RxD

3 TxD

4 DTR

5 SG

6 DSR

7 RTS

8 CTS

9 RI

The Network sends the message terminated by an EOM. When the message has been processed the MultiMech Controller sends the response.

It should be notified that the MultiMech is not ready to receive a new message until the EOM character in the response has been transmitted from the MultiMech.

**6.6 Signal timing**

In the following pages some examples are shown of the timing of control signals in different situations.

Signal name

Idle Receiving command

Executing command

Sending reply

PC

end

MultiMech

end

0.05 - 180 s

Min 10 ms

RTS

CTS Don 't ca re

Max 10 ms

Ma x 1 s

CTS

RTS

Active

In active

TxD

RxD

RxD

TxD

Example: Normal situation.

Example: Receive time-out or Buffer overflow.

Signal name

Idle R eceiving command

Sending reply if

PC

end

MultiMech

end

PC RTS

active

Min 1 0 m s

RTS

CTS

Max 10 ms

CTS

RTS

TxD

RxD

Tran sm iss ion ab orte d

RxD

TxD

Example: Transmission delay.

Signal name

Idle Receiving command

Executing command

Sending reply

PC

end

NMD

end

Max 1 s

RTS

CTS

CTS

RTS

TxD

RxD

RxD

TxD

**7 FIRMWARE UPDATE**

**7.1 Using TMA1001**

The program required to send the “start boot loader” command and manage the update process is called “Talaris MultiMech Ace” (TMA).

The equipment and prerequisites required to upload new firmware to the MultiMech are therefore:

• PC with “Talaris MultiMech Ace “ installed. (Version released with TB)

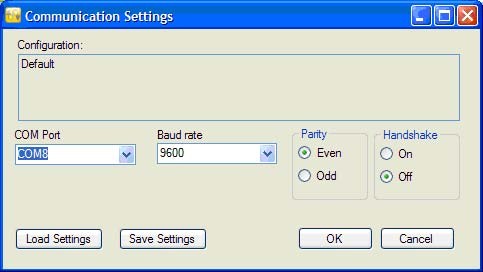
• A firmware update file, e.g. AB20120102.hex (the firmware version number followed by a hex extension, the file is in Intel hex format).

• Serial communication cable to connect the MultiMech to the PC.

• Powered MultiMech with firmware level 2012-01.XX.

**l**

**The procedure to upload new firmware:**



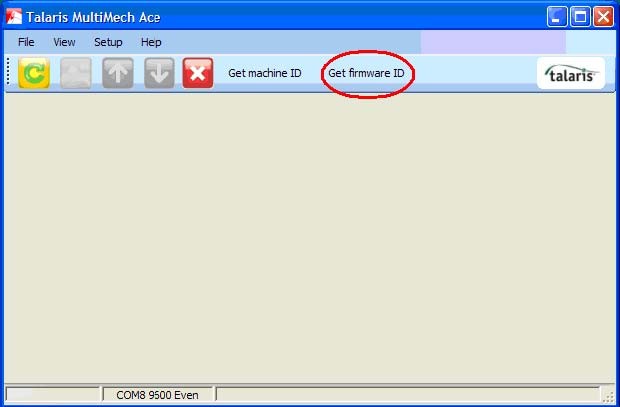
1. Switch on the MultiMech and check that the green

LEDs on the front of the PCB are flashing.

2. Connect a communication cable between the MultiMech and the PC.

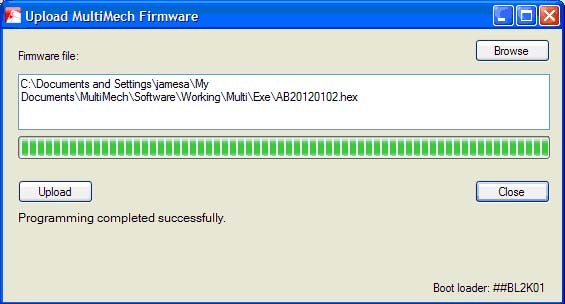
3. Start “Talaris MultiMech Ace 1.0.0.1” and check that under “Setup → Communications” the communications settings are “your COM port”, 9600, even parity, handshake off.

4. Click on the tool bar text “Get firmware ID” to verify that the test program can communicate with the MultiMech.



The “Get firmware ID” text should change to the currently installed firmware version. (If the text does not change to the currently installed firmware version then there is a communications problem.)

5. Select “File → Upload MultiMech



Firmware”.

6. Browse to the updated firmware file, e.g. AB20120102.hex.

7. Click

“Upload”.

8. Wait for the progress indicator to move to the right and for the “Programming completed successfully” message.

9. Wait for the green LEDs on the front of the PCB to start flashing, then click on the firmware version text on the tool bar (see picture in step 4). Verify that the MultiMech reports the updated firmware version.

If any problems are encountered take a note of the problem message text. The procedure can be restarted by switching off / on the MultiMech power and restarting the update process from step 5 (Select “File → Upload MultiMech Firmware”).

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The company is committed to the highest ethical standards and compliance with legislation and to be a fair employer wherever we operate. As a responsible organisation we maintain a disciplined approach to our corporate governance and operate to the optimum professional standards in all aspects of our business.

Talaris will always seek to provide a safe and productive work environment where all employees can grow and be challenged. Wherever we operate our objective is to contribute actively to the community and the local environment. An intrinsic part of our business philosophy across our product and service offerings is to be consistently environmentally responsible and to continue to improve our performance across all environmental issues wherever possible.

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